

Chapter 4

Measures and Preliminary Alternatives

As described in Chapter 2, alternative plan formulation is an iterative process. Once water resources problems, needs, and opportunities have been identified, and planning objectives, constraints, considerations, and criteria have been developed, the next major elements of the planning process are (1) identifying management measures that may address one or more objectives, (2) formulating alternatives to meet these objectives, and (3) comparing and evaluating the alternatives.

This chapter of the Special Report describes the process to evaluate a range of measures and develop a set of preliminary alternatives, based on a range of Truckee Canal flow stages paired with selected measures that, in combination, address the identified problems and needs of the Newlands Project and achieve the Study objectives.

Structure of Planning Study Alternatives

All alternatives formulated for this Study must meet both the safety and water supply objectives described in Chapter 2. The 2008 and 2011 Truckee Canal Risk Assessments and the Corrective Action Study (Reclamation 2008c, 2011d,

Measures: A management measure is any structural or nonstructural action or feature that could address one or more planning objectives, consistent with other planning considerations, criteria, and constraints. At each step of the planning process, measures are reviewed, and in some cases reconsidered and incorporated into alternatives or eliminated from further consideration.

Alternatives: An alternative (sometimes called “alternative plan”) is a course of action to resolve an identified problem. Most alternatives include a combination of measures for implementation, but some alternatives are considered “no action” because they represent the most likely future condition absent any action to address the problem.

e) identify a host of repairs and other actions that, when undertaken, will allow the Truckee Canal to operate safely. This Study relies upon those recommendations for measures to satisfy the safety objective, and incorporates these as initial building blocks for building preliminary alternatives that, overall, will also achieve the Study’s water supply objective.

Approaches for meeting the safety objective are distinguished by a range of actions and allowable flow stages for the Truckee Canal; this range of flow stages directly affects the ability of the Newlands Project to provide water supply reliability to Project water rights holders. As such, development of each alternative requires determination of whether additional measures are necessary to also achieve the water supply objective. This section first describes the measures for

meeting the safety objective and, second, the measures for meeting the water supply objective.

Measures Identified for Achieving Safe Operations of the Truckee Canal

Actions identified to reduce the risk of the Truckee Canal's embankment failing include physical repairs, upgrades, and reduced flow stages. This section describes how measures have been identified and may be combined with reduced canal flow stages to meet the Study's safety objective.

Truckee Canal Flow Stages

Each alternative will be constructed by first selecting a target flow stage for the Truckee Canal. The following bullets describe the range of flow stages considered:

- **600, 350, and 250 cfs Flow Stages** – At flow stages between 600 cfs and 250 cfs, each measure for achieving safety includes a number of general upgrades to checks, wasteways, conduits, and takeouts, with three different options for structural improvements along the length of the canal surface or embankment. Through these measures, the corrective actions address defects that have developed within the canal embankment, and the increased risk resulting from a transition in land use around the canal from agricultural cultivation to residential communities. Each measure provides for meeting the RR3 standard of safety, which is required for achieving this Study's safety objective.
- **0 cfs Flow Stage** – The Corrective Action Study evaluated reducing the risk of canal failure by decommissioning the canal from use. Decommissioning the canal would address all of the public safety risks its use currently poses, as well as risks that an abandoned canal might pose without further action (e.g., attractive nuisances and stormwater drainage).
- **150 cfs Flow Stage** – This Study includes a 150 cfs flow stage as a method for achieving the safety objective. Although this flow stage was not evaluated in the Corrective Action Study, Reclamation previously determined that the Truckee Canal could safely operate at this level without additional repairs or upgrades (Reclamation 2008c, d). The 150 cfs flow stage reflects the operational and capacity restrictions on the Truckee Canal under the "Likely Future Conditions" described in Chapter 3.

Structural Integrity Improvements Along the Truckee Canal

The Corrective Action Study identified three techniques for improving the structural integrity along approximately 17 miles of the Truckee Canal's embankments: 1.7 miles of the 10.3-mile Derby Reach and 4.2 miles of the 9.7-mile Lahontan Reach, which have relatively low population densities near the canal; and the full 11.1 miles of the Fernley Reach, which has the greatest

population density along the canal and thus the greatest risk. These three techniques can be applied equally in combination with the other measures to satisfy the safety objective at flow stages of 250, 350, and 600 cfs. The three techniques identified for improving structural integrity along the length of the canal are:

1. **Concrete and geomembrane lining** – For this lining option, a low-density polyethylene geomembrane 40 thousandth of an inch thick would be placed on the canal's prism (along the sides and bottom of the structure) and covered by a layer of unreinforced concrete 3 inches thick. The canal section would be designed to a smaller cross-section prism than the existing channel geometry. The concrete lining protects the geomembrane from being damaged during maintenance work or large debris flows, and by animals. Seepage into the canal embankment would essentially be eliminated in the sections of the canal where the geomembrane and concrete liner are installed. This would also reduce losses from the canal due to seepage by up to 85 percent. Once the lining system is in place, all static failure modes evaluated for the canal would be eliminated. Depending on the flow stage selected, the estimated field cost for a full canal concrete and geomembrane lining ranges from \$53 million to \$59 million.
2. **Cement bentonite cutoff wall** – For this non-lining option, a trench would be excavated in the centerline of the canal embankment and filled with a slurry mix of cement, bentonite, and water. Exposed defects, such as animal burrows or cracks, within the trench would also be filled with the slurry. The cement bentonite slurry would harden over time to form an impermeable barrier within the canal embankment. The excavated soil and slurry from the trench would be used to reshape the canal embankment, as needed. The installation of a cement bentonite cutoff wall would eliminate all of the existing seepage paths and provide a deterrent to future rodent activity through the canal embankment. Depending on the flow stage selected, the estimated field cost for a cement bentonite cutoff wall ranges from \$50 million to \$56 million.
3. **High-density polyethylene cutoff wall** – For this non-lining option, interlocking panels of high-density polyethylene (HDPE) would be pushed and vibrated into the centerline of the canal embankment. The installation of an HDPE wall would eliminate all of the existing seepage paths and eliminate the potential for future rodent activity through the canal embankment. A cap would be installed at the crest to prevent damage to the top of the HDPE geomembrane wall. Depending on the flow stage selected, the cost for an HDPE cutoff wall ranges from \$40 million to \$44 million.

The three techniques will help meet the safety objective, addressing risk at RR3, equally well; however, they differ in regard to cost and in their performance characteristics. For instance, the concrete and geomembrane lining technique would significantly reduce losses from the Truckee Canal by acting as a barrier against seepage, but is also the most expensive option. In contrast, neither of the cutoff wall techniques would reduce seepage losses from the canal into the surrounding groundwater aquifers, although these options have lower costs. It is possible that these costs could be reduced if value engineering were performed for these safety measures.

The lower cost techniques appear to be attractive options, given that all three provide the same level of risk reduction for meeting the safety objective. However, if additional seepage-reduction benefits are necessary to meet the water supply objective, the higher cost technique, concrete and geomembrane lining, may be considered. Among the lower cost techniques, the cement bentonite cutoff wall is more expensive than the HDPE cutoff wall, but provides no additional water supply or safety benefits to justify its higher costs. For the purposes of formulating preliminary alternatives, the lower cost option for HDPE cutoff walls is assumed to be the starting point. The decision to bear the additional costs associated with selecting concrete and geomembrane lining is made in concert with decisions to select other measures for meeting the water supply objective.

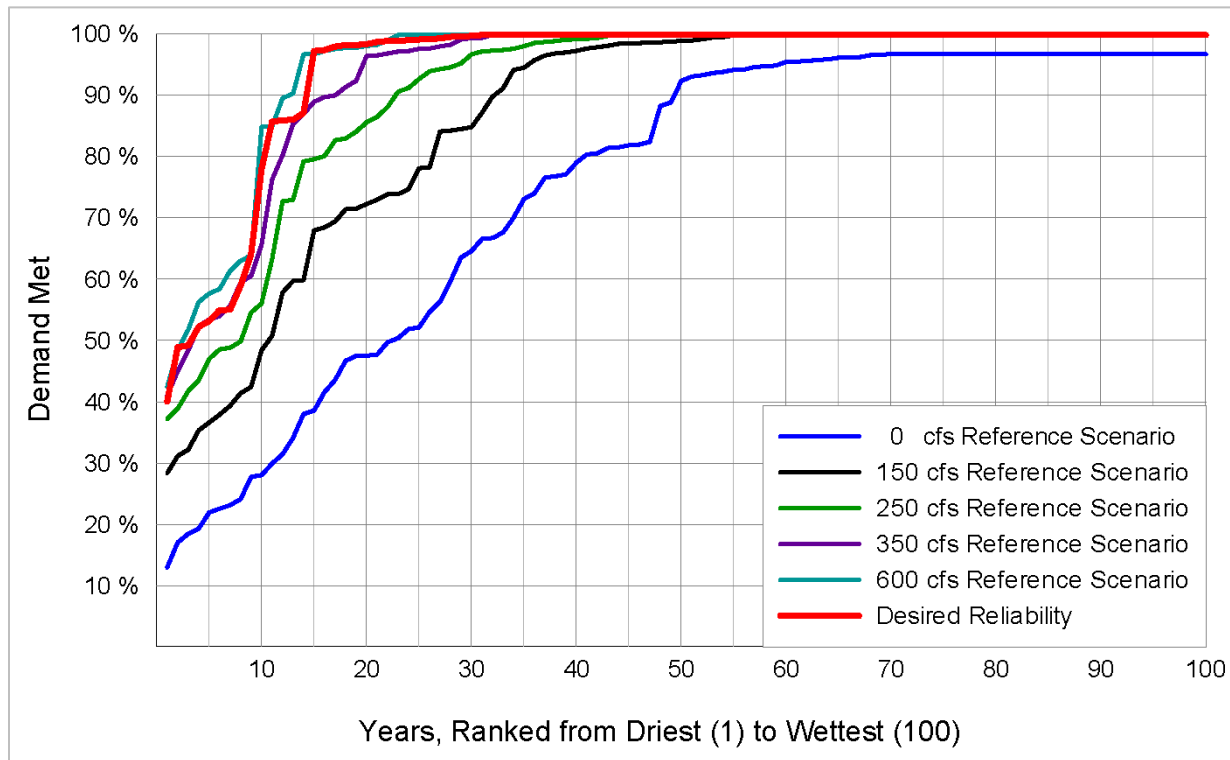
In parallel with this Study, Reclamation is refining the hydrologic analysis used in developing the above safety measures. The updated analysis may reduce the assessed risks of natural runoff, and thereby reduce the extents and cost of structural requirements for safety options. The revised hydrology study was completed in 2012. Development of additional analyses will be required to update cost estimates for the safety measures, but is unlikely to occur before the completion of this Study.

Reference Scenarios: For this Study, Newlands Project water supply reliability has been simulated at a range of Truckee Canal flow stages and for Desired Reliability conditions, taking into account anticipated future levels of Project demand. These are termed “reference scenarios.” Each flow-stage reference scenario is used as the basis for comparing how well each meets Project demand, and for determining what must be done to achieve reliability levels similar to the Desired Reliability scenario.

Measures Needed to Meet Water Supply Objective

The safety measures for the Truckee Canal described above will ensure all alternatives developed meet the Study’s safety objective, but – like the 150 cfs flow-stage restriction described in Chapter 3 – they may also result in a less reliable supply of water for Project users when compared to Desired Reliability conditions.

The Study involved several analyses to determine the extent of shortages in meeting future water rights under each flow stage considered in alternatives formulation (Appendix D1).



Key: cfs = cubic feet per second

Figure 4-1. Newlands Project Water Supply Reliability Under all Reference Scenarios

Based on the Study's analyses, a number of general conclusions are possible about the reliability under each flow-stage reference scenario (Figure 4-1), absent any additional safety methods or water supply measures:

- In general, water supply reliability conditions under the 600 cfs reference scenario are slightly better than Desired Reliability conditions.
- Reliability under the 350 cfs reference scenario is nearly identical to the Desired Reliability scenario in the driest and wettest of years, but offers slightly lower levels of reliability during what were more moderate shortage conditions under the Desired Reliability scenario.
- Reliability under the 250 cfs reference scenario is lower than the Desired Reliability in all years.
- Reliability under the 150 cfs reference scenario contains approximately double the volume of shortfalls as the 250 cfs reference scenario, in

comparison to the Desired Reliability. Shortages are exacerbated most in the driest years and in prolonged droughts.

- For conditions under the 0 cfs reference scenario, reliability is significantly lower than under the Desired Reliability scenario, with water supply shortages for the Carson Division occurring in approximately half of all years. The 0 cfs flow-stage reference scenario never achieves Desired Reliability for the Truckee Division, because if the Truckee Canal is decommissioned, Project water rights holders in the Truckee Division will need to be served through an alternate mechanism.

Water Supply Measures Identified and Evaluated

One of the Study's requirements is to formulate and evaluate alternatives for a range of potential Truckee Canal flow stages. Thus, combination of these flow stages along with the previously identified safety measures established the initial range of preliminary alternatives. Starting with the selection of a given flow stage, the potential water supply shortage that remains – when compared to the Desired Reliability – establishes the needs to be met or targets to be reached through the addition of one or more water supply measures (Figure 4-2).

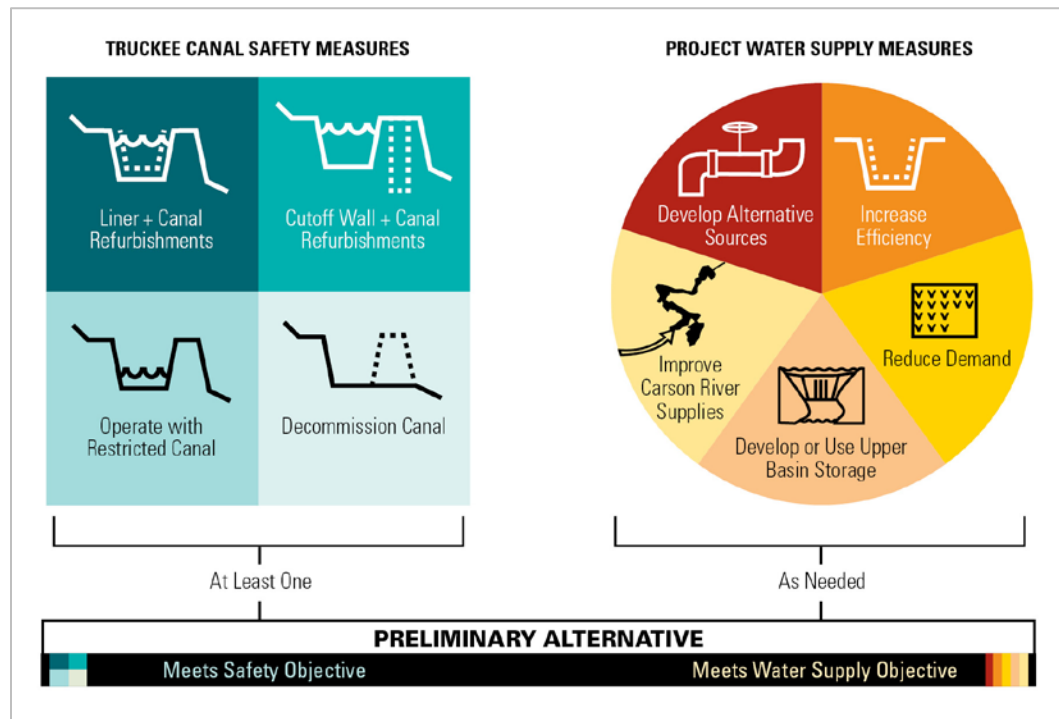


Figure 4-2. Structure of Alternatives to Meet Study Objectives

More than 50 potential water supply measures were initially identified for the Study based on information from previous studies, programs, and projects. These measures were reviewed and others developed during Study team

meetings, field inspections, and meetings to discuss the Study with Project stakeholders, agencies, and the public. Measures were grouped into 5 broad categories based on their intent or purpose, and further organized into 18 subcategories to allow for easy comparison and evaluation.

A list of all the measures identified and their selected characteristics appears in this chapter, and a full description of each measure and its evaluation is included in Appendix E1.

Develop Alternative Sources Measures in this category provide alternative sources of supply or means of delivery to ensure water rights holders throughout the Project receive water reliably in the future. In some cases, the alternative sources are new supplies not already derived from the Carson or Truckee rivers. In other cases, the alternative source is existing Project water to be delivered in a different manner or from an alternate conveyance mechanism—specifically, many of these measures are intended to ensure a system is in place that allows the Truckee Division to exercise its water rights, regardless of the state or condition of the Truckee Canal.

Develop or Use Upper Basin Storage Measures in this category were identified to develop additional storage in the upper Carson River Basin for use by the Newlands Project, or to use existing upstream storage on the Truckee River. These measures would contribute to the water supply objective of this Study by (1) capturing additional water during excess conditions for later delivery, or (2) providing more flexibility to deliver Project water when it is most useful.

Improve Carson River Supplies Measures in this category seek to improve the reliability of supplies in Lahontan Reservoir through the reductions in reservoir spill or increases in dependable inflow from the Carson River. This includes expanded monitoring of upstream diversions and changing enforcement of the *Alpine* Decree to improve flows to Lahontan Reservoir. These measures contribute to the objectives of this Study by increasing the volume of water available for delivery to Carson Division water rights holders, and reducing dependence upon supplies from the Truckee Canal.

Increase Efficiency Measures in this category focus on achieving more efficient or effective use of Project water supplies, especially within the Carson Division. These measures contribute to the water rights reliability objective of this Study by using water at Lahontan Reservoir more effectively, or by reducing the overall losses within the Project. As a result, they produce either lower shortfalls in dry conditions, or greater carryover storages in normal or wet conditions.

Reduce Agricultural Demand Measures in this category focus on reducing Newlands Project water demands, either during drought conditions or permanently. Methods vary widely within this category, ranging from financial

assistance programs to the retirement of water rights. These measures seek to contribute to the water supply objective by better balancing the demands for water with the available supplies in any given year.

Consideration of Measures for Water Supply Objective

This section describes the process and information used to consider and screen each measure identified to meet the water supply objective, or to compare measures within their categories and subcategories where appropriate to determine which represented the best options for use in alternatives.

Measures Screening Process

Once the measures were identified, the Study team initiated a screening process to help identify the measures that represent the best candidates for further evaluation and consideration. This process narrowed the list of measures by eliminating any that were unlikely to be included in alternatives, and then ranked and compared the remaining measures based on their relative attractiveness for potential inclusion in alternatives.

Phase 1: Initial Screening

Initially, screening relied on existing information and input received during meetings with the public, cities and counties, Federal agencies, regional agencies, and tribes; feedback from Reclamation staff in the Lahontan Basin Area Office; information obtained from reference material described in Chapter 1 and cited throughout this report; and Study team judgment. New analyses were conducted when additional information was required to complete the evaluations. To complete this initial step in screening, measures were evaluated based on three general categories: (1) implementation considerations, (2) environmental effects, and (3) water supply performance. Although this part of the screening process is qualitative and subjective in nature, it aims to identify the measures to be evaluated further in the planning process and remove measures from further consideration if their overall intent or likely outcome will not contribute to achieving Study objectives, or if they contain an aspect that represents a severe barrier or challenge to implementation.

- **Implementation considerations** are the factors and conditions that will affect whether a measure is likely or feasible to implement. Such considerations may include institutional hurdles or legality, political or public acceptability, regulatory requirements or hurdles, and the level of complexity or need for cooperation from multiple parties.
- **Environmental effects** are the environmental resource conditions that are expected to change as a consequence of a measure's implementation. In some cases, these effects are small and may be mitigable; in others, the expected effects are severe enough to reduce the attractiveness of the measure's potential water supply benefits.

- **Water supply performance** is a reflection of a measure's expected contributions to or effectiveness in meeting the Study's water supply objective. Specifically, it is described in terms of potential yield, magnitude of the yield in years with shortages, overall performance achieving its intent, and, if relevant or useful, cost effectiveness.

As a result of this initial evaluation, 18 of the 51 measures examined were judged to have a high likelihood to encounter serious conflicts or result in adverse conditions in these three assessments, and thus were eliminated from further evaluation and consideration for use in formulating alternatives (see Table 4-3, beginning on page 4-17 of this chapter).

Phase 2: Secondary Analyses

For the 33 measures that remained following Phase 1 screening, the Study team began a second, more robust assessment to estimate each measure's cost and contributions to meeting the water supply objective, alone or in combination. Several analyses contributed to this step in the screening process and are summarized in multiple appendices to this Special Report. Where possible, these analyses included sensitivity studies to evaluate entire subcategories of measures. The analyses produced a number of technical conclusions that guided development of preliminary alternatives, summarized below.

- **Water supply conditions vary considerably between a Desired Reliability scenario and the various other Truckee Canal flow-stage reference scenarios used for building alternatives.** The reference scenarios are the foundation for building alternatives, with the goal of including measures until the resulting conditions meet or exceed the water supply conditions of the Desired Reliability scenario. (See Appendix D1, "Effects of Truckee Canal Capacity on Newlands Project Water Supply.")
- **Reducing seepage from the Truckee Canal provides a considerable enhancement to the reliability of Newlands Project.** The reliability improvements appear to be greatest for the 600 cfs and 350 cfs flow-stage scenarios. (See Appendix D2, "Effects of Truckee Canal Losses on Newlands Project Water Supply.")
- **Reducing demand through permanent land retirement or crop insurance/fallowing programs is one possible mechanism for balancing demand under a future condition with a capacity-limited Truckee Canal.** If relied upon alone, rather modest reductions in demand are sufficient for achieving reliability under some of the flow stages (250 cfs and 350 cfs). For the 150 cfs flow-stage condition, reliability could be achieved with permanent retirement or temporary fallowing of 20 percent to 40 percent of the actively irrigated Project land. For the 0 cfs condition, the required acreage of retirement grows to 40 percent to 60 percent of the Carson Division, with separate

requirements for the Truckee Division. (See Appendix D3, “Effects of Reducing Demand on Newlands Project Water Supply.”)

- **Increasing the delivery efficiency of the Carson Division’s canals and laterals shows an appreciable benefit to Project reliability.** Measures that bring Project efficiency to 75 percent may be able to meet the water supply objectives for several flow stages (250 cfs and 350 cfs) alone. Even with the possibility that increased efficiency would require reclassifying some land at a higher water duty, the benefit of efficiency gains exceed these potential diminishments. (See Appendix D4, “Effects of Increasing the Efficiency of Deliveries on Newlands Project Water Supply.”)
- **Increased inflows from the Carson River to Lahontan Reservoir do not result in improved water supply reliability for the Project.** Even if it were possible to securely deliver upper Carson River Basin water to Lahontan Reservoir, there can be no carryover from yearly storage of these additional flows due to the nature of OCAP. Storage in the upper Carson River Basin showed some opportunity, though the actual opportunity to benefit from acquiring storage rights was deemed marginal because the Project would need to acquire nearly all upstream Carson River storage to produce a perceptible water supply benefit. (See Appendix D5, “Effects of Acquiring Additional Carson River Storage and Water Rights on Newlands Project Water Supply.”)
- **Although it cannot be evaluated completely for this Study, there appear to be significant opportunities for the Newlands Project to benefit from upstream storage in the Truckee River Basin.** (See Appendix D6, “Potential Opportunities to Store Newlands Project Water in Truckee River Reservoirs.”)
- **New storage at Lahontan Reservoir is unlikely to benefit the Project.** The regulations in OCAP that limit diversions from the Truckee River relative to storage targets in Lahontan Reservoir also have the effect of limiting the value of developing additional storage in Lahontan Reservoir. For example, a larger Lahontan Reservoir does capture more water during wet conditions but, because of OCAP storage target limitations, higher carry-over storages result in lower Truckee River diversions instead of higher water supply availability for the Project. New storage was removed from consideration due to the findings in this appendix. (See Appendix D7, “Effects of Storage Increases on Newlands Project Water Supply.”)

Based on the secondary analyses, 18 measures were eliminated for further evaluation, as they generally showed no appreciable water supply reliability improvements (see Table 4-3, beginning on page 4-17 of this chapter). The remaining measures were retained for consideration in Phase 3 because of their

ability to contribute meaningfully to meeting the water supply objective. The second phase of screening also uncovered compatibilities among the measures and Truckee Canal flow stages, which provided a basis for ranking the measures for inclusion in preliminary alternatives.

Phase 3: Selection of Measures for Preliminary Alternatives

During the third phase of screening, measures were identified for use in preliminary alternatives based upon their relative performance compared with similar measures, and their effectiveness and compatibility with other measures. Two measures not selected during this phase were removed from consideration in this Study (see Table 4-3, beginning on page 4-17 of this chapter).

Preliminary alternatives were built in several stages as follows, beginning with the flow stage reference scenario alone.

1. The amount of unmet Project demand that could occur under a given flow-stage condition was assessed by comparing the flow-stage reference scenarios developed for each flow stage with the Desired Reliability.
2. The initial flow-stage condition, paired with a safety measure, was then combined with measures that could offer the largest benefit in terms of relative water supply performance or cost effectiveness. The subcategory of measures that appeared to be the most effective and achievable was considered first. Measures within the subcategory were selected based on how much of the shortage (unmet Project demand) they are anticipated to erase at a given flow stage, relative to the Desired Reliability – in other words, how close they bring the Project to the Desired Reliability level.
3. If additional water supply gains were still necessary for the preliminary alternative to reach the level under the Desired Reliability, the Study team added more measures until no additional gains were possible from measures within that subcategory.
4. If additional water supply gains were still necessary to meet the water supply objective, the next-most-effective subcategory of measures was considered and additional measures were applied until the preliminary alternative met both the safety and water supply objectives.

Through this systematic approach, several preliminary alternatives were developed that used the full range of subcategories that had been advanced through phases 1 and 2 of the measures screening process. However, during the process of assembling preliminary alternatives, several measures that had been retained through previous rounds of screening did not emerge as the most efficient or effective measures for meeting the water supply goal for any of the

preliminary alternatives. As a result, these measures were not retained for further evaluation in the preliminary alternatives.

Summary of Screening Results

This Study did not apply the same screening process described above to the safety measures, as Reclamation previously formulated and evaluated these options in the Corrective Action Study (Reclamation 2011e). As such, the following subsection focuses on the water supply measures that were retained through the screening process, and also identifies the measures that were eliminated from further consideration. For context, the range of measures identified for reducing risk from operations of the Truckee Canal that may be used in preliminary alternatives are shown in Table 4-1.

Table 4-1. Safety Measures for Potential Use in Preliminary Alternatives

| Measure | | Estimated Field Cost ¹ (\$ millions) | Estimated Annual Cost ² (\$ millions) |
|------------------------------------|--|--|---|
| 600 cfs flow stage ³ | Concrete/ Geomembrane Lining | \$59 | \$2.8 |
| | CB Cutoff Wall | \$56 | \$2.7 |
| | HDPE Cutoff Wall | \$44 | \$2.1 |
| 350 cfs flow stage ³ | Concrete/ Geomembrane Lining | \$59 | \$2.8 |
| | CB Cutoff Wall | \$56 | \$2.7 |
| | HDPE Cutoff Wall | \$44 | \$2.1 |
| 250 cfs flow stage ^{3, 4} | Concrete/ Geomembrane Lining | \$59 | \$2.8 |
| | CB Cutoff Wall | \$56 | \$2.7 |
| | HDPE Cutoff Wall | \$44 | \$2.1 |
| 0 cfs flow stage | Truckee Canal Decommissioning | \$11 | \$0.52 |
| 150 cfs flow stage | TBD/Likely Future Without-Action Condition | \$0.13 | \$0.016 |

Notes:

¹ Field cost is an estimate of capital costs of a feature or project from award to construction closeout, but does not represent total construction costs, which are the sum of field costs and non-contract costs. Allowances for mobilization, design contingencies, procurement strategies, and construction contingencies are included in field cost. Non-contract costs are not included in the field cost. Non-contract costs refer to costs of work or service provided in support of the Project, and other work that can be attributed to the Project as a whole, known as distributed costs, which include facilitating services, investigations, design and specifications, construction management, environmental compliance, and archeological considerations. Costs were indexed to January 2012 using Reclamation's Construction Cost Trends (Reclamation 2012).

² Annual costs include interest and amortization of the field cost based on the current Federal discount rate of 4 percent, over an assumed service life. Typically, interest and amortization is determined using total capital costs (construction cost plus interest during construction); however, total capital costs were not available. Operation and maintenance (O&M) costs are included in the annual costs and are typically expressed as a percentage of the field or construction cost for preliminary and/or appraisal level estimates. O&M costs were indexed to January 2012 using Reclamation's Construction Cost Trends (Reclamation 2012).

³ Up to \$1.7 million in field costs could be saved for 600 cfs, 350 cfs, and 250 cfs safety measures because of the recent TCID Truckee Canal turnout replacements.

⁴ Costs for the 250 cfs flow stage were presented as a "transport-only" option in the *Corrective Action Study* (2011e), and differ from the 350 cfs flow stage because the turnout and check structure replacements are not included. For this Study, those structural features would be required and costs are assumed to be same as the 350 cfs flow stage.

Key:

CB = cement bentonite

cfs = cubic feet per second

HDPE = High Density Polyethylene

TBD = to be determined

Tables 4-2 and 4-3 summarize the results from the screening process for each measure considered. Table 4-2 includes all of the measures that were retained for use in preliminary alternatives, along with select characteristics such as potential yield, estimated field costs, and annualized costs. Table 4-3 presents comparable information, where available, for the measures that were not retained, and also provides a brief reason for eliminating each from further consideration by the Study.

Table 4-2. Water Supply Measures Retained for Potential Use in Preliminary Alternatives

| Category | Subcategory | Measure | Source/Suggestion for Measure | Estimated Annual Yield | Estimated Field Cost¹ (\$ million) | Estimated Annual Cost² (\$ million) |
|-----------------------------|---|---|---------------------------------------|-------------------------------|--|---|
| Develop Alternative Sources | Supplement Truckee Division Supply | Treat Effluent and Deliver for Agricultural Use | Study Team | 1,700 AF | \$0 – \$13 | \$0 – \$1.85 |
| | Supplement Carson Division Supply | Import Dixie Valley Groundwater | Churchill County 2007 | 35,000 AF | \$63 – \$135 | \$4.4 – \$11 |
| | Establish New Truckee Division Points of Diversion and Delivery | Construct Pipeline to Agricultural Users ⁴ | Study Team | 1,100 – 3,300 AF | \$110 – \$120 | \$7.9 – \$8.6 |
| Increase Efficiency | Reduce Carson Division Seepage | Compact Soil Lining of Main Canals and Laterals | Study Team | 26,100 – 36,200 AF | \$1.7 – \$4.5 | \$0.4 – \$1.05 |
| | | Line Main Canals and Laterals | Reclamation 1994 and 2009b; 1997 OCAP | 26,100 – 36,200 AF | \$135– \$195 | \$6.6 – \$9.4 |
| | Reduce Truckee Division Seepage | Compact Soil Lining of the Truckee Canal | Study Team | 10,000 – 15,000 AF | \$0.78 – \$1.55 | \$0.19 – \$0.37 |
| | | Line Truckee Canal | Reclamation 1994, 2009b, and 2011e | 10,000 – 15,000 AF | \$0 – \$15.0 | \$0 – \$0.73 |
| Reduce Agricultural Demand | Modify Land Uses | Acquire and Retire Water Rights | Reclamation 1994 and 2009b | 3.5 – 4.5 AF per acre | \$1.285 per TAF ³ | \$0.074 per TAF ³ |

Table 4-2. Water Supply Measures Retained for Potential Use in Preliminary Alternatives (contd.)

| Category | Subcategory | Measure | Source/Suggestion for Measure | Estimated Annual Yield | Estimated Field Cost ¹ (\$ million) | Estimated Annual Cost ² (\$ million) |
|------------------------------------|------------------------------|--|---|------------------------|--|---|
| Reduce Agricultural Demand | Reduce Dry-Year Demand | Crop Insurance/Fallowing | Pyramid Lake Paiute Tribe and Stetson Engineering | Varies | \$0.065 - \$0.1 per TAF per year ³ | \$0.065 – \$0.1 per TAF ³ |
| | | Partial Season Forbearance Agreements | Pyramid Lake Paiute Tribe and Stetson Engineering | Varies | \$0.065 - \$0.1 per TAF per year ³ | \$0.065 – \$0.1 per TAF ³ |
| Develop or Use Upper Basin Storage | Access Truckee River Storage | Multi-Year Upstream Storage ⁵ | TCID (Rusty Jardine and Walt Winder, June 2011) | Unknown | Unknown | Unknown |

Note:

¹ Field cost is an estimate of capital costs of a feature or project from award to construction closeout, but does not represent total construction costs, which are the sum of field costs and non-contract costs. Allowances for mobilization, design contingencies, procurement strategies, and construction contingencies are included in field cost. Non-contract costs are not included in the field cost; some cost estimate sources reported construction costs and were adjusted to reflect field costs by removing non-contract costs outlined in the cost estimate. Non-contract costs refer to costs of work or service provided in support of the Project, and other work that can be attributed to the Project as a whole, known as distributed costs, which include facilitating services, investigations, design and specifications, construction management, environmental compliance, and archeological considerations. Costs not developed by MWH were indexed to January 2012 using Reclamation's Construction Cost Trends (Reclamation 2012).

² Annual costs include interest and amortization of the field cost based on the current Federal discount rate of 4 percent, over an assumed service life. Typically, interest and amortization is determined using total capital costs (construction cost plus interest during construction); however, total capital costs were not available. Operation and maintenance (O&M) costs are included in the annual costs and are typically expressed as a percentage of the field or construction cost for preliminary and/or appraisal level estimates. O&M costs estimated at source price level were indexed to January 2012 using Reclamation's Construction Cost Trends (Reclamation 2012).

³ These are not field costs and only represent a portion of non-contract costs related to land acquisition.

⁴ Yield for this measure represents the volume of water that is delivered to agricultural users via the Truckee Canal, but will need to be delivered through an alternate conveyance for alternatives that consider decommissioning the Truckee Canal.

⁵ Measure is retained in concept only and will *not* be used in any preliminary or final Study alternative (see Appendix D6).

Key:

AF = acre-foot

NA = not applicable

TAF = thousand acre feet

TBD = to be determined

TC = Truckee Canal lateral

Table 4-3. Water Supply Measures Not Retained for Use in Preliminary Alternatives

| Category | Subcategory | Measure | Phase of Elimination During Measures Screening | Rationale for Status |
|------------------------------------|---|--|--|--|
| Develop Alternative Sources | Replace Truckee Canal Supply | Construct Carson River Pipeline to Serve Agricultural Users | Phase 1 | High institutional barriers to implementation. |
| | | Develop Local Groundwater to Serve Agricultural Users | Phase 1 | Conflicts with current Nevada laws and regulations. |
| | | Develop Local Groundwater to Supply Stockwater | Phase 1 | Conflicts with current Nevada laws and regulations, low anticipated contributions to water supply objective. |
| | Establish New Truckee Division Points of Diversion and Delivery | Construct Truckee River Intake and Pipeline to City of Fernley | Phase 3 | Surface water diversion system to be planned and implemented separately by the City of Fernley. Field cost ¹ is estimated at \$8.9 million to \$14 million. Annual cost ² is estimated at \$0.86 million to \$1.35 million. |
| | | Deliver from TC-1 | Phase 3 | Surface water diversion system to be planned and implemented separately by the City of Fernley. Field cost ¹ is estimated at - \$0.94 million to \$1.25 million. Annual cost ² is estimated at - \$0.046 million to \$0.061 million. |
| | | | | |
| Develop or Use Upper Basin Storage | Access Truckee River Storage | Deliver TCID Supplies from Donner Lake | Phase 2 | High institutional barriers to implementation. |
| | Increase Storage in the Upper Carson Basin | Construct East Fork Carson Reservoir | Phase 1 | Unlikely contributions to meeting water supply objective, high institutional barriers to implementation, and large potential environmental concerns. |
| | | Expand or Dedicate Existing Carson Reservoirs | Phase 2 | Uncertain contributions to meeting the water supply objective and high institutional barriers to implementation. |
| Improve Carson River Supplies | Improve Storage Below Lahontan Dam | Dredge or Reshape Sheckler Reservoir | Phase 1 | Low anticipated contributions to water supply objective. |
| | | Storage at Naval Bombing Range | Phase 1 | Low anticipated contributions to water supply objective and restrictions on non-military activities and public access at the potential storage site. |
| | | Storage on Tribal Lands | Phase 1 | Low anticipated contributions to water supply objective and minimal benefit to the overall Project. |

Table 4-3. Water Supply Measures Not Retained for Use in Preliminary Alternatives (contd.)

| Category | Subcategory | Measure | Phase of Elimination During Measures Screening | Rationale for Status |
|--|--|---|--|--|
| Improve Carson River Supplies (contd.) | Increase Lahontan Dam Storage | Open Carp Dam | Phase 2 | Low anticipated contributions to water supply objective. |
| | | Raise Dam | Phase 2 | Low anticipated contributions to water supply objective. |
| | | Retrofit or Improve Flashboards | Phase 2 | Low anticipated contributions to water supply objective. |
| | Reduce Diversions from Upper Carson Basin | Change Enforcement of Alpine Decree | Phase 2 | High institutional barriers and uncertain contributions to meeting the water supply objective. |
| | | Purchase and Retire Upper Carson River Rights | Phase 2 | Low anticipated contributions to water supply objective. |
| Increase Efficiency | Improve Carson Division Delivery Operations | Automate/Telemeter Structures | Phase 1 | Uncertain contributions to meeting water supply objective. |
| | | Community Rotation System | Phase 1 | Low anticipated contributions to water supply objective. |
| | | Drain Canals in Non-Irrigation Seasons | Phase 1 | Appears to be in practice already. Low anticipated contributions to water supply objective. |
| | | Improve Ditch Rider Training | Phase 1 | Uncertain contributions to meeting water supply objective. |
| | | Meter or Calibrate Checks and Takeouts | Phase 1 | Majority of volume delivered is metered already. Low anticipated contributions to water supply objective. |
| | | Reuse Agricultural Drain Water | Phase 2 | Low anticipated contributions to water supply objective. |
| | Improve Truckee Division Delivery Operations | Automate Derby Dam and Check Structures | Phase 1 | Low direct contributions to meeting water supply objective. |
| | Reduce Carson Division Seepage | Compact Regulating Reservoir Beds | Phase 3 | High cost and low anticipated contributions to water supply objective. Annual yield is estimated at 3,960 AF. Field cost ¹ is estimated at \$14.5 million to \$29 million. Annual cost ² is estimated at \$3.3 million to \$6.7 million. |
| | | Line Regulating Reservoirs | Phase 3 | High cost and low anticipated contributions to water supply objective. Annual yield is up to 4,400 AF. Field cost ¹ is estimated at \$58 million to \$100 million. Annual cost ² is estimated at \$2.8 million to \$4.9 million. |
| | | Replace Main Canals and Laterals with Pipes | Phase 1 | High anticipated implementation costs. |

Table 4-3. Water Supply Measures Not Retained for Use in Preliminary Alternatives (contd.)

| Category | Subcategory | Measure | Screening Phase of Elimination | Rationale for Status |
|------------------------------|----------------------------------|---|--------------------------------|---|
| Increase Efficiency (contd.) | Reduce Truckee Division Seepage | Compact Soil Lining of Truckee Canal Laterals | Phase 2 | Low anticipated cost effectiveness. |
| | | Line Truckee Canal Laterals | Phase 2 | Low anticipated cost effectiveness. |
| | | Replace Truckee Canal Laterals with Pipes | Phase 2 | Low anticipated cost effectiveness. |
| | | Replace Truckee Canal with Pipes | Phase 2 | Low anticipated cost effectiveness. |
| Reduce Agricultural Demand | Improve On-farm Efficiency | Laser-level Fields | Phase 1 | Low anticipated contributions to water supply objective. |
| | | Transition to Sprinkler Technology | Phase 2 | Low anticipated cost effectiveness. Field cost ¹ is estimated at \$110 million. Annual cost ² is estimated at \$11 million. |
| | Incentivize Reductions in Demand | Base Fees on Cost of Delivery | Phase 2 | Low anticipated contributions to water supply objective. |
| | | Base Fees on Volume Used | Phase 2 | Low anticipated contributions to water supply objective. |
| | | Establish Fees for Stockwater Delivery | Phase 2 | Low anticipated contributions to meeting water supply objective and to potential conflicts with Project water rights. |
| | | Subsidize Crop Conversions | Phase 1 | Implementation challenges. |
| | Lease or Transfer Water Rights | Lease Water Rights | Phase 1 | Uncertain contributions to meeting water supply objective. |
| | | Transfer Water Rights | Phase 1 | Politically and publicly unacceptable. |
| | Modify Land Uses | Purchase and Retire Strategic Parcels | Phase 2 | Politically and publicly unacceptable. |
| | | Subsidize Relocation of Properties to Consolidate Project | Phase 2 | Implementation challenges. |

Table 4-3. Water Supply Measures Not Retained for Use in Preliminary Alternatives (contd.)

Notes:

¹ Field cost is an estimate of capital costs of a feature or project from award to construction closeout, but does not represent total construction costs, which are the sum of field costs and non-contract costs. Allowances for mobilization, design contingencies, procurement strategies, and construction contingencies are included in field cost. Non-contract costs are not included in the field cost; some cost estimate sources reported construction costs and were adjusted to reflect field costs by removing non-contract costs outlined in the cost estimate. Non-contract costs refer to costs of work or service provided in support of the Project, and other work that can be attributed to the Project as a whole, known as distributed costs, which include facilitating services, investigations, design and specifications, construction management, environmental compliance, and archeological considerations. Costs not developed by MWH were indexed to January 2012 using Reclamation's Construction Cost Trends (Reclamation 2012).

² Annual costs include interest and amortization of the field cost based on the current Federal discount rate of 4 percent, over an assumed service life. Typically, interest and amortization is determined using total capital costs (construction cost plus interest during construction); however, total capital costs were not available. Operation and maintenance (O&M) costs are included in the annual costs and are typically expressed as a percentage of the field or construction cost for preliminary and/or appraisal level estimates. O&M costs estimated at source price level were indexed to January 2012 using Reclamation's Construction Cost Trends (Reclamation 2012).

³ These are not field costs and only represent a portion of non-contract costs related to land acquisition.

Key:

AF = acre-foot

TCID = Truckee-Carson Irrigation District

Descriptions of Retained Water Supply Measures

The measures included in summary in Table 4-2 were all retained for potential use in the Study's preliminary alternatives because they were judged to offer large contributions toward meeting the Study's water supply objective. The sections below summarize the concept for each measure and also explain why each was retained.

The analyses supporting many of the determinations below appear in Appendix D1 through D7 to this report. Appendix E1, "Consideration of Measures for Water Supply Objective," contains descriptions for the full set of measures identified and evaluated during the Study.

Project-wide Measures

The majority of the measures considered by the Study could either apply to, or affect, the entire Project's water supply reliability. These measures were not intended to target a specific division of the Project, although they may apply to or logically fit better with one division over another due to the different characteristics of each.

Import Dixie Valley Groundwater

Measure Category: Develop Alternative Sources

Measure Subcategory: Supplement Carson Division Supply

Location in Appendix E1: Page E-1-8

Retained for Flow Stages: 0 cfs, 150 cfs, 250 cfs, and 350 cfs

This measure considers delivering groundwater from Dixie Valley for use in the Carson Division and is based on a proposal developed and studied by Churchill County. This measure includes a range of actions depending on the desired capacity (5,000 – 11,000 gallons per minute) for facilities to deliver Dixie Valley supplies into the Lahontan Valley. Construction of several facilities would be required, including a pressurized pipeline that would cross over Sand Pass adjacent to Highway 50, groundwater wells, one or several large-scale pumping plants, a treatment facility to remove arsenic and fluoride, electrical transmission lines (Churchill County 2007).

Pumping Dixie Valley's groundwater into the Lahontan Valley could contribute to the water supply objective of this Study by augmenting supply for the Carson Division in all years, effectively reducing the total Project demand supplied from the existing Project.

Line (Carson Division) Main Canals and Laterals

Measure Category: Increase Efficiency

Measure Subcategory: Reduce Carson Division Seepage

Location in Appendix E1: Page E-1-40

Retained for Flow Stages: 0 cfs, 150 cfs, 250 cfs, and 350 cfs

This measure considers the installation of a 4-inch concrete lining with a geomembrane liner to prevent seepage along up to 55 miles of conveyance facilities in the Carson Division. This measure only considers lining the main canals and laterals where seepage losses are greatest, based on conclusions of the *Newlands Project Efficiency Study* (Efficiency Study, Reclamation 1994). “Appendix C” to the Efficiency Study evaluated three possible extents for lining canals and laterals to improve conveyance efficiency in the Carson Division: “Option 1” proposes lining portions of the V, S, L, and A canals; “Option 1 Expanded” increases the extent beyond Option 1 by also lining portions of the S Canal and L1 lateral; and “Option 1 Expanded plus T Canal” increases the extent beyond Option 1 Expanded by also lining portions of the T Canal (see Table 4-4).

Table 4-4. Extent of Carson Division Canal Rehabilitation Considered for Study

| 1994 Efficiency Study Option | Extent of Canal Improvement |
|--------------------------------|-----------------------------|
| Option 1 | 34.3 miles |
| Option 1 Expanded | 44.9 miles |
| Option 1 Expanded plus T Canal | 54.5 miles |

Source: Reclamation 1994

The “Option 1 Expanded” lining approach was retained for its potential to increase Project conveyance efficiency. By reducing the amount of water that is lost due to seepage within the Carson Division, this measure would make more efficient use of water stored at Lahontan Reservoir, effectively augmenting the division’s supply. The amount of seepage reduced may vary, depending on the lining option selected and the total volume of deliveries to the Carson Division.

Compact Soil Lining of (Carson Division) Main Canals and Laterals

Measure Category: Increase Efficiency

Measure Subcategory: Reduce Carson Division Seepage

Location in Appendix E1: Page E-1-38

Retained for Flow Stages: 0 cfs, 150 cfs, 250 cfs, and 350 cfs

This measure considers vibratory compaction techniques to compress the upper 2 feet of soil in the Carson Division’s earth-lined canals and laterals to reduce seepage losses. This measure only considers compacting the main canals and laterals, where seepage losses are greatest, based on conclusions of the Efficiency Study (Reclamation 1994). Although the Efficiency Study did not include compaction options for seepage reduction, this Study is considering it as a potentially lower cost alternative to concrete geomembrane lining. The Study selected three possible extents for implementing a soil compaction measure to reduce seepage from the Carson Division’s canals and laterals; each is based on an option for canal/lateral lining that was originally evaluated by the Efficiency Study, and is described in Table 4-4 above.

Unlike the preceding canal lining measure, both “Option 1 Expanded” and “Option 1 Expanded plus T Canal” compaction extents were retained to account for the uncertain effectiveness of compaction techniques in the Carson Division. Previous studies have concluded that *in situ* vibratory compaction performed on agricultural canals with predominantly sandy loam soils can reduce seepage losses by up to 90 percent (Burt et al. 2010); however, the extent of seepage reductions has not been specifically verified in the Project boundaries.

By reducing the amount of water that is lost due to seepage within the Carson Division, this measure would make more efficient use of water stored at Lahontan Reservoir, effectively augmenting the division’s supply. The amount of seepage reduced may vary, depending on the compaction option selected and the total volume of deliveries to the Carson Division.

Line Truckee Canal

Measure Category: Increase Efficiency

Measure Subcategory: Reduce Truckee Division Seepage

Location in Appendix E1: Page E-1-46

Retained for Flow Stages: 250 cfs and 350 cfs

This measure considers lining the Truckee Canal with an impermeable geomembrane covered by unreinforced concrete, as described in the section of this chapter titled “Measures Identified for Achieving Safe Operations of the Truckee Canal” and in Table 4-1. In addition to reducing seepage losses, this measure would help resolve some of the canal's structural problems caused by animal burrowing. By reducing seepage losses from the Truckee Canal, lining would contribute significantly to meeting the water supply objective.

The total volume of seepage losses may vary, depending on total volume of deliveries through the Truckee Canal; however, it is estimated that the lining option recommended as a safety measure would achieve an 85 percent reduction from current seepage levels.

At flow stages of 250 cfs and 350 cfs, lining the Truckee Canal would both achieve the safety objective and contribute significantly toward achieving the water supply objective.

Compact Soil Lining of the Truckee Canal

Measure Category: Increase Efficiency

Measure Subcategory: Reduce Truckee Division Seepage

Location in Appendix E1: Page E-1-44

Retained for Flow Stages: 150 cfs

This measure considers vibratory compaction techniques to compress the upper 2 feet of soil in the earth-lined portions of the Truckee Canal, and also includes construction activities along the entire structure. By reducing seepage losses

from the Truckee Canal, compaction would help meet the water supply objective.

Soil compaction is retained only for alternatives with an active Truckee Canal, but without structural integrity improvements along the length of the canal; compaction performs a similar function to lining. It could not be used in conjunction with a cutoff wall due to potential damage to the structure during the compaction process.

Previous studies have concluded that in-situ vibratory compaction performed on agricultural canals with predominantly sandy loam soils can reduce seepage losses by up to 90 percent (Burt et al. 2010); however, the extent of seepage reductions has not been specifically verified for the Truckee Canal.

Acquire and Retire Water Rights

Measure Category: Reduce Agricultural Demand

Measure Subcategory: Modify Land Uses

Location in Appendix E1: Page E-1-59

Retained for Flow Stages: 0 cfs, 150 cfs, 250 cfs, and 350 cfs

This measure seeks to retire a sufficient volume of water rights that the remaining Newlands Project water rights can be considered reliable. Water rights would be obtained from willing sellers and would then be retired from production thereby reducing the volume of shortage experienced by the Project's remaining water rights holders.

Unlike some of the other water supply measures, the ability of water rights acquisitions to meet the water supply objective is almost entirely contingent on the level of participation by willing sellers. However, if sufficient funding and willing sellers exist, it represents a significant and direct mechanism for meeting the Study's water supply objective. There may be an opportunity to apply this measure in a manner that also contributes to the goals of the USFWS Water Rights Acquisition Program for Lahontan Valley Wetlands, if the USFWS program has not yet achieved its goals by the time that a Study alternative is implemented.

Crop Insurance/Fallowing

Measure Category: Reduce Agricultural Demand

Measure Subcategory: Reduce Dry-Year Demand

Location in Appendix E1: Page E-1-61

Retained for Flow Stages: 0 cfs, 150 cfs, 250 cfs, and 350 cfs

This measure considers compensating water rights holders for lost production if they agree not to exercise their rights during drier years. It would help reduce Project demand during years when deliveries from the Truckee Canal are needed to supplement low water levels in Lahontan Reservoir, which could help

ensure that Project water rights holders receive water reliably, even under conditions that include a lower flow in the Truckee Canal.

As with “Acquire and Retire Water Rights,” the success of crop insurance/fallowing in helping to meet the water supply objective is contingent the level of participation by willing individuals, as well as the extent of land that is temporarily pulled out of production. Similar voluntary demand reduction programs have seen a maximum participation rate of about 30 percent. As such, this Study assumes 30 percent as a maximum for potential participation, although actual participation rates could be much lower given that the program would be voluntary and might vary considerably year-to-year.

Partial Season Forbearance Agreements

Measure Category: Reduce Agricultural Demand

Measure Subcategory: Reduce Dry-Year Demand

Location in Appendix E1: Page E-1-63

Retained for Flow Stages: 0 cfs, 150 cfs, 250 cfs, and 350 cfs

This measure would compensate water rights holders to end irrigation and crop production earlier during drier years than they ordinarily would. This effectively shortens the irrigation season for many farmers. The terms, conditions, and payment for exercising this option would be preestablished in individual forbearance agreements before the irrigation season began. As with “Crop Insurance/Fallowing,” this measure would help reduce Project demand during years when deliveries from the Truckee Canal are needed to supplement low water levels in Lahontan Reservoir, which could help ensure that Project water rights holders receive water reliably even under conditions that include a lower flow in the Truckee Canal.

As with “Acquire and Retire Water Rights” and “Crop Insurance/Fallowing,” the success of partial season forbearance agreements in helping to meet the water supply objective is contingent on the level of participation by willing individuals, as well as the terms of the agreements and the extent of the land subject to the agreements. Like “Crop Insurance/Fallowing,” the maximum potential participation is assumed to be 30 percent.

Multi-Year Upstream Storage

Measure Category: Develop or Use Upper Basin Storage

Measure Subcategory: Access Truckee River Storage

Location in Appendix E1: Page E-1-17

This measure would allow Newlands Project supplies from the Truckee River (Claim 3 under the *Orr Ditch* Decree) to be stored in upstream reservoirs on the Truckee River (e.g., Prosser Reservoir) during periods when either the Truckee Canal or Lahontan Reservoir are incapable of capturing, storing, or delivering those supplies. It considers allowing those supplies to be held in upstream reservoirs as carry over from year-to-year until such a time that they could be

delivered for the Project's use. In so doing, it helps the Project cope with a capacity-limited Truckee Canal by providing flexibility to divert Claim 3 water into the canal at Derby Dam at a time when conveyance to Project water users is possible.

Rationale for Retaining in Concept Only While physically possible, institutional arrangements do not exist to allow Truckee Canal water rights to remain in Truckee River reservoirs over multiple years. This Study finds that facilitating multi-year Project storage in upstream Truckee River reservoirs shows promise as the cheapest and most effective method for improving the reliability of Project water supplies, regardless of the Truckee Canal's capacity.

Currently, OCAP does not allow Project water rights holders to store water for multiple years in upstream Truckee River reservoirs for release and diversion through the Truckee Canal during drier years. TROA – which is not yet implemented – does allow its signatories considerable flexibility to exchange water supplies and storage space to ensure water is available when needed for human and environmental uses; however, Newlands Project water rights holders are not signatories to TROA. To implement this measure, an agreement would likely need to be negotiated separately among TCID, Reclamation, and one or more signatories to TROA, such as TMWA or the Pyramid Lake Paiute Tribe. Given the ultimate withdrawal of TCID from the TROA negotiations, and the large number of ongoing TROA-related lawsuits, appears to be institutionally difficult at this time.

The institutional barriers that currently prevent multi-year storage by the Project also prevent a comprehensive evaluation of its potential. However, this Study conducted preliminary assessment to test its broad applicability to the Study's water supply objective, which is described in Appendix D6, "Potential Opportunities to Store Newlands Project Water in Truckee River Reservoirs." An appropriate technical evaluation would require the development of computer logic describing very specific constraints on such a storage program. The development of an appropriate framework of constraints would require the willing participation of several stakeholders, most of whom are already TROA signatories. Without such participation, development of specific constraints by this Study would have been highly speculative, and would not have produced helpful results.

Institutional complications aside, the Study's evaluation of the measure suggests that it is technically possible to reduce considerable volumes of Project shortages through the multi-year storage of Project water in upstream Truckee River reservoirs. Given that this requires institutional agreements, and not construction, this measure appears to be high-value and low-cost solution for satisfying the Study's water supply objective. The potential value of this measure leads the Study to retain the measure, but the uncertainty surrounding the necessary institutional agreements needed to facilitate its implementation

leads the Study to retain multi-year storage “in concept only.” As such, this measure will not be used in either preliminary or final Study alternatives.

Truckee Division-Specific Measures

A certain subset of measures apply to the Project’s Truckee Division, only. These, along with others not selected for use in preliminary alternatives, were identified specifically to serve the water rights (agricultural and M&I) of the Truckee Division under alternatives that include measures which would reduce the majority of seepage from the Truckee Canal or decommission the structure from future use.

Construct Pipeline to Agricultural Users

Measure Category: Develop Alternative Sources

Measure Subcategory: Establish New Truckee Division Points of Diversion and Delivery

Location in Appendix E1: Page E-1-10

Retained for Flow Stages: 0 cfs and 150 cfs (with “Compact Soil Lining of the Truckee Canal”)

This measure serves agricultural water rights in the Truckee Division from the Truckee River. It includes construction of a 50 cfs, 1,700-horsepower pump station and pipeline (approximately 18.3 miles) to convey these supplies to the head works of the current distribution laterals (TC-01 to TC-13). For alternatives where the Truckee Canal capacity is limited, this measure increases the capacity available for conveyance to Lahontan Reservoir. For alternatives where the Truckee Canal’s flow stage is 0 cfs, this measure serves rights within the Truckee Division without conveying water through the Fernley Reach.

This measure could be combined with the measure to serve agriculture in the Fernley area from treated effluent (“Treat Effluent and Deliver for Agricultural Use”).

Treat Effluent and Deliver for Agricultural Use

Measure Category: Develop Alternative Sources

Measure Subcategory: Supplement Truckee Division Supply

Location in Appendix E1: Page E-1-6

Retained for Flow Stages: 0 cfs

This measure serves agricultural water rights in the Truckee Division with a supplemental supply of water derived from treated wastewater from the City of Fernley’s East Wastewater Treatment Facility. The facility is a secondary treatment plant with a current average treatment volume of 1.5 million gallons per day (City of Fernley 2008b). At present, there are no plans for the City of Fernley to reuse treated wastewater, and it is discharged to the Fernley Wildlife Management Area and infiltrated into the local aquifer. Modifications would be required to the current treatment process to provide a higher level of filtration and disinfection (similar to California Title 22 drinking standards) for

stockwater use or use on agricultural fields. Depending on the actual use, for instance if all supplies are applied to fields and not applied to stock, then the current level of treatment could be sufficient and the additional cost of tertiary treatment may be avoided. This measure would also require a conveyance equivalent to the “Construct Pipeline to Agricultural Users” measure for the Truckee Division. Using treated effluent as an alternative water supply source was retained because it offers the possibility to meet one-quarter of the anticipated maximum future demand from Truckee Division’s agricultural users.

Process for Developing Preliminary Alternatives

Preliminary alternatives have been assembled under the range of Truckee Canal flow-stage conditions (600 cfs, 350 cfs, 250 cfs, 150 cfs, and 0 cfs) for meeting the safety objective. As discussed above, the first step in developing preliminary alternatives is conducting an assessment of the water supply performance of the Newlands Project at each flow stage absent other measures; this is called the reference scenario. Water supply performance is measured relative to a Desired Reliability scenario that represents the desired water supply conditions for the Project.

Comparison of Water Supply Conditions

The following sections present water supply reliability at each flow-stage reference scenario relative to the Desired Reliability in two ways. In the first figure for each flow stage, the annual water supply condition for each scenario is simulated for a 100-year period. These years are ranked by the percent of Project demand met, from the driest years to the wettest years, and plotted to compare the frequency and magnitude of water supply shortages (conditions in which not all of the demands were met). The percent of Project demands met differs for all the scenarios, and those differences provide a basis for assessing water supply reliability for the Study at each flow stage.

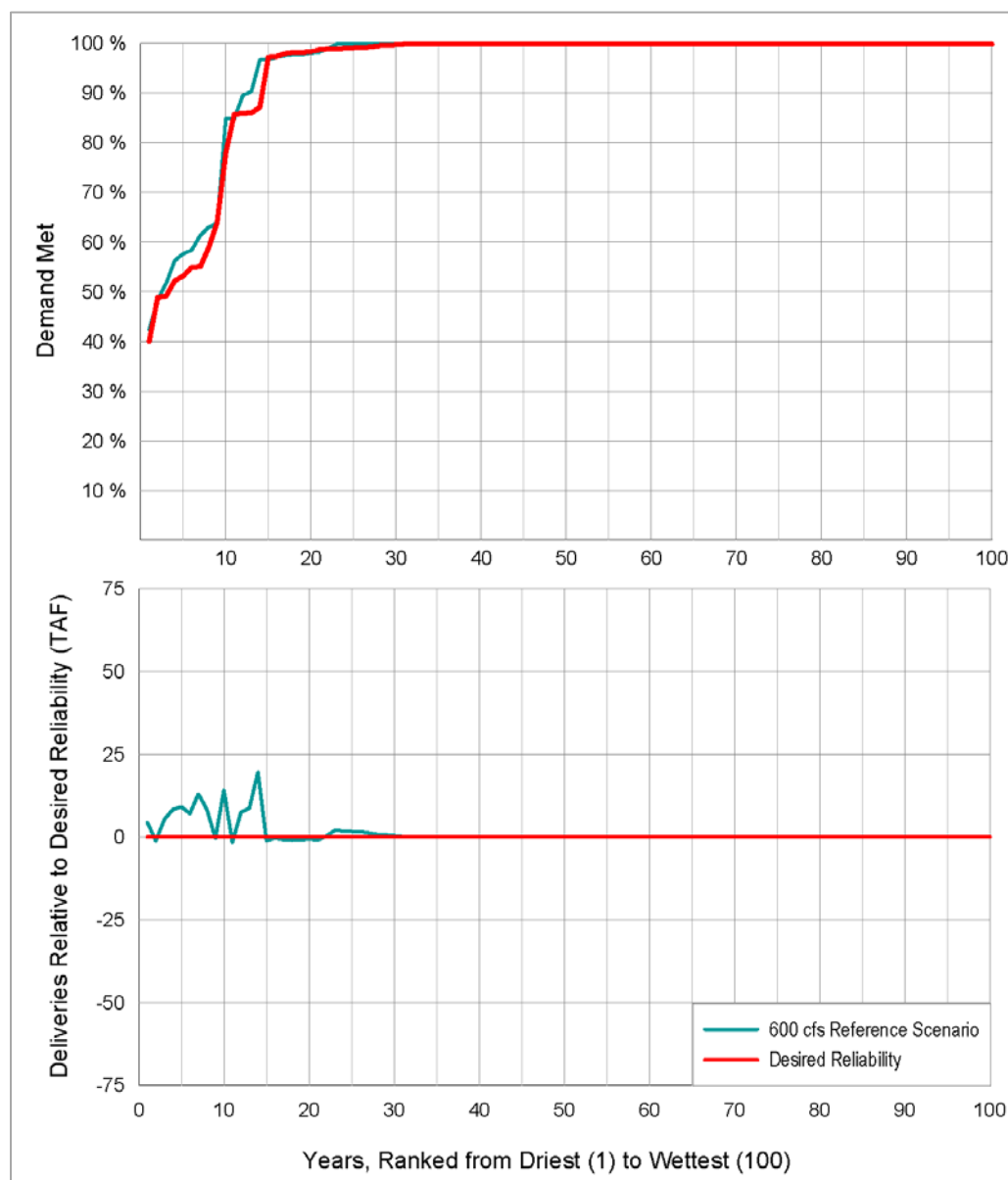
In the second figure for each flow-stage scenario, the differences in demand met between the flow-stage reference scenario and the Desired Reliability scenario (expressed as a percentage met in the first figure) are translated into a volume. The translation from percent difference to volume considers the likely future Project demand in the reference scenario so that the second figures reveal the volume of demand that would need to be developed to meet or exceed the Desired Reliability scenario.

More complete characterizations and comparisons of the reference and Desired Reliability scenarios are provided in Appendix D1.

Water Supply Conditions for the 600 cfs Reference Scenario

As shown in Figure 4-3, significant water supply shortages occur for both scenarios in the driest years, but the 600 cfs reference scenario has a very

similar percent and volume of demand met when compared to the Desired Reliability scenario for the full range of water supply conditions.

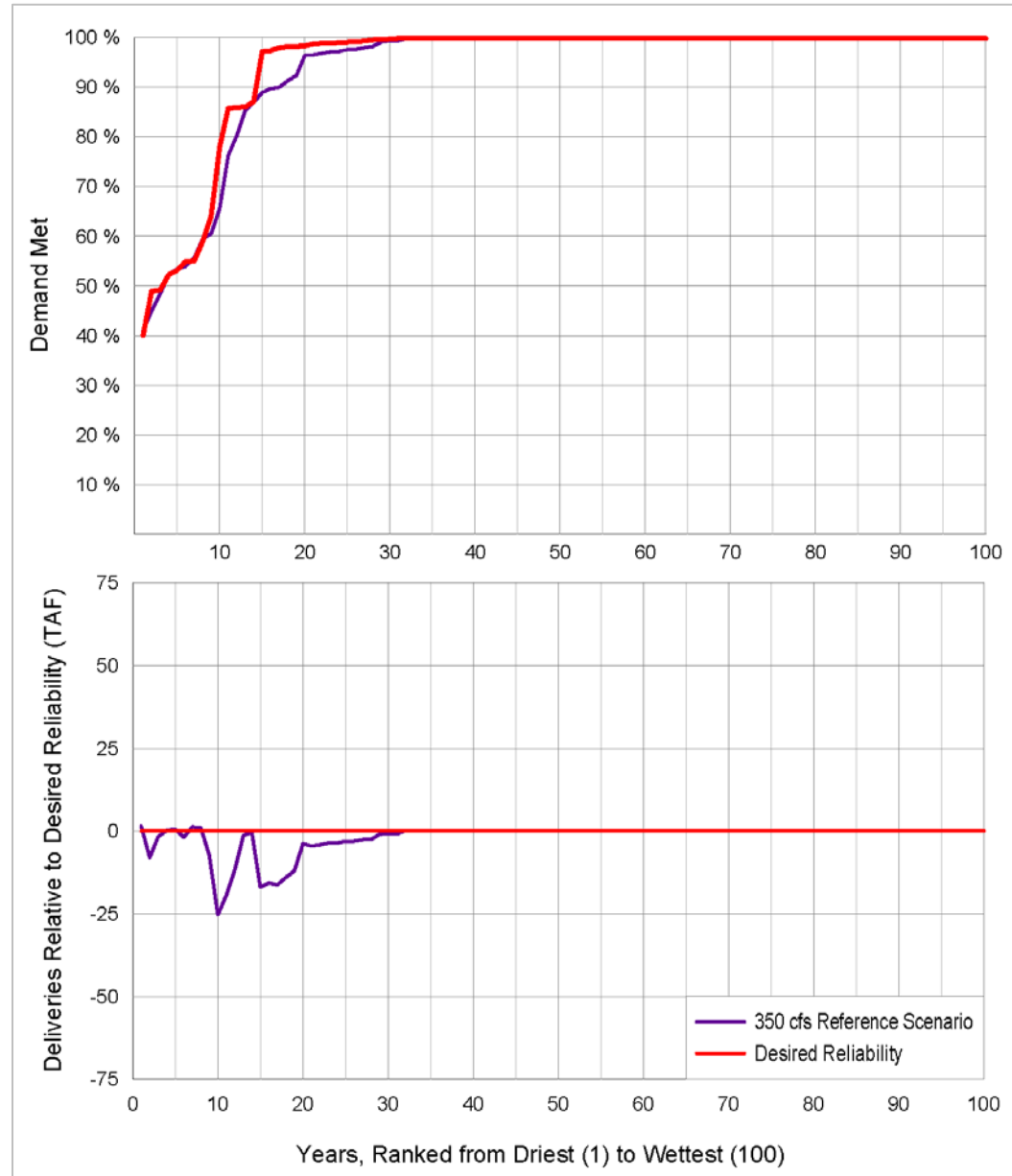


Key: cfs = cubic feet per second

Figure 4-3. Relative Performance of Truckee Canal 600 cfs Flow-Stage Reference Scenarios on Annual Newlands Project Deliveries

Water Supply Conditions for the 350 cfs Reference Scenario

As demonstrated in Figure 4-4, the 350 cfs flow-stage reference scenario provides a level of water supply reliability that, essentially, equals the Desired Reliability in the driest 10 years or the wettest 70 years. However, reliability falls as much as 12 percent below the Desired Reliability condition for approximately 20 of the 100 years evaluated. In the bottom graph, with the total delivery volume under the Desired Reliability as a baseline, the 350 cfs reference scenario results in a net shortage of 176,000 acre-feet over the period of evaluation.



Key: cfs = cubic feet per second; TAF = thousand acre-feet

Figure 4-4. Relative Performance of Truckee Canal 350 cfs Flow-Stage Reference Scenarios on Annual Newlands Project Deliveries

Water Supply Conditions for the 250 cfs Reference Scenario

As demonstrated in Figure 4-5, the 250 cfs flow-stage reference scenario provides a level of reliability that only meets the Desired Reliability in 55 years of the 100 years evaluated. Reliability falls as much as 22 percent below the Desired Reliability condition in approximately 45 of the 100 years evaluated. In the bottom graph, with the total delivery volume under the Desired Reliability as a baseline, the 250 cfs reference scenario results in a net shortage of 660,000 acre-feet over the period of evaluation.

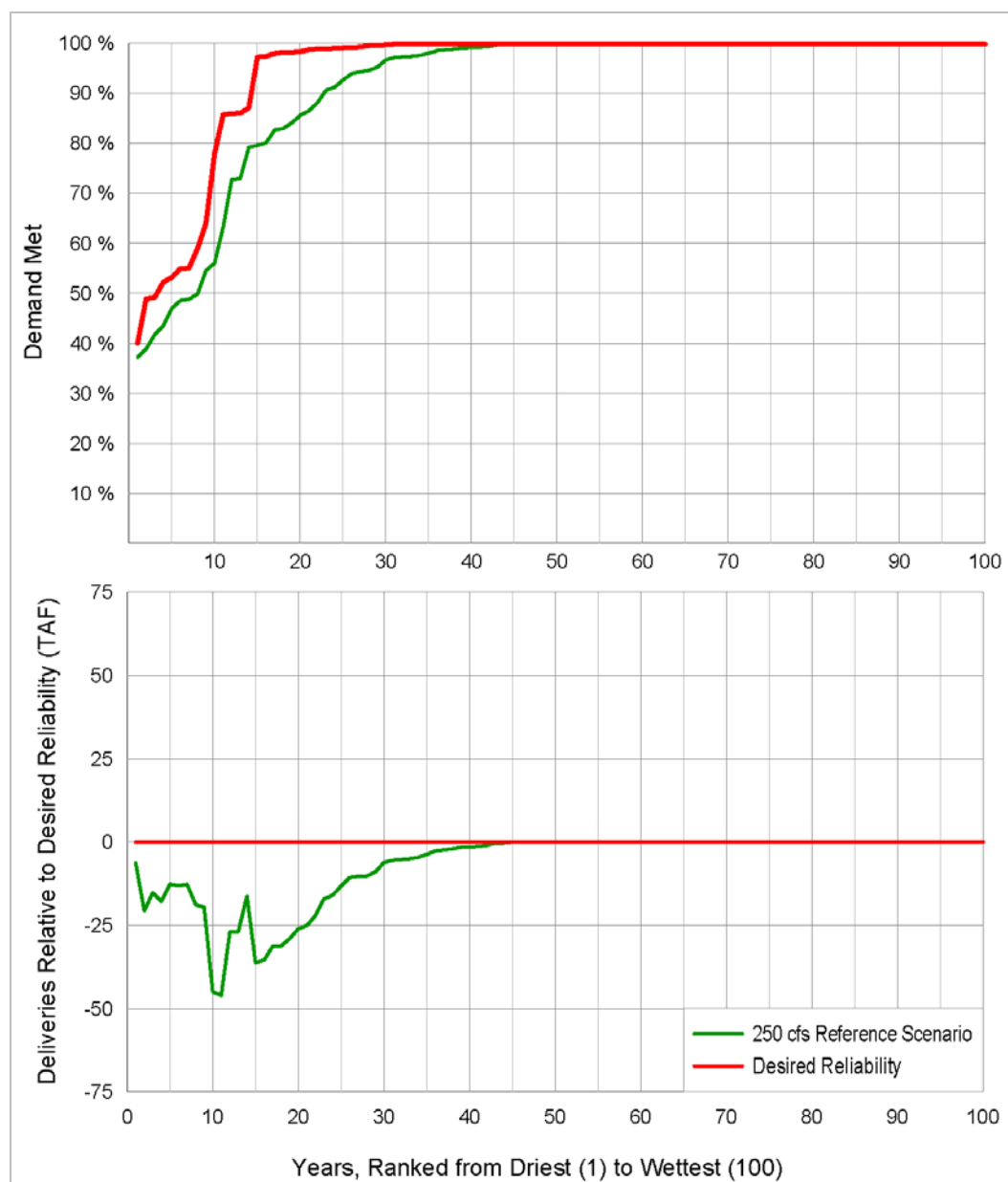
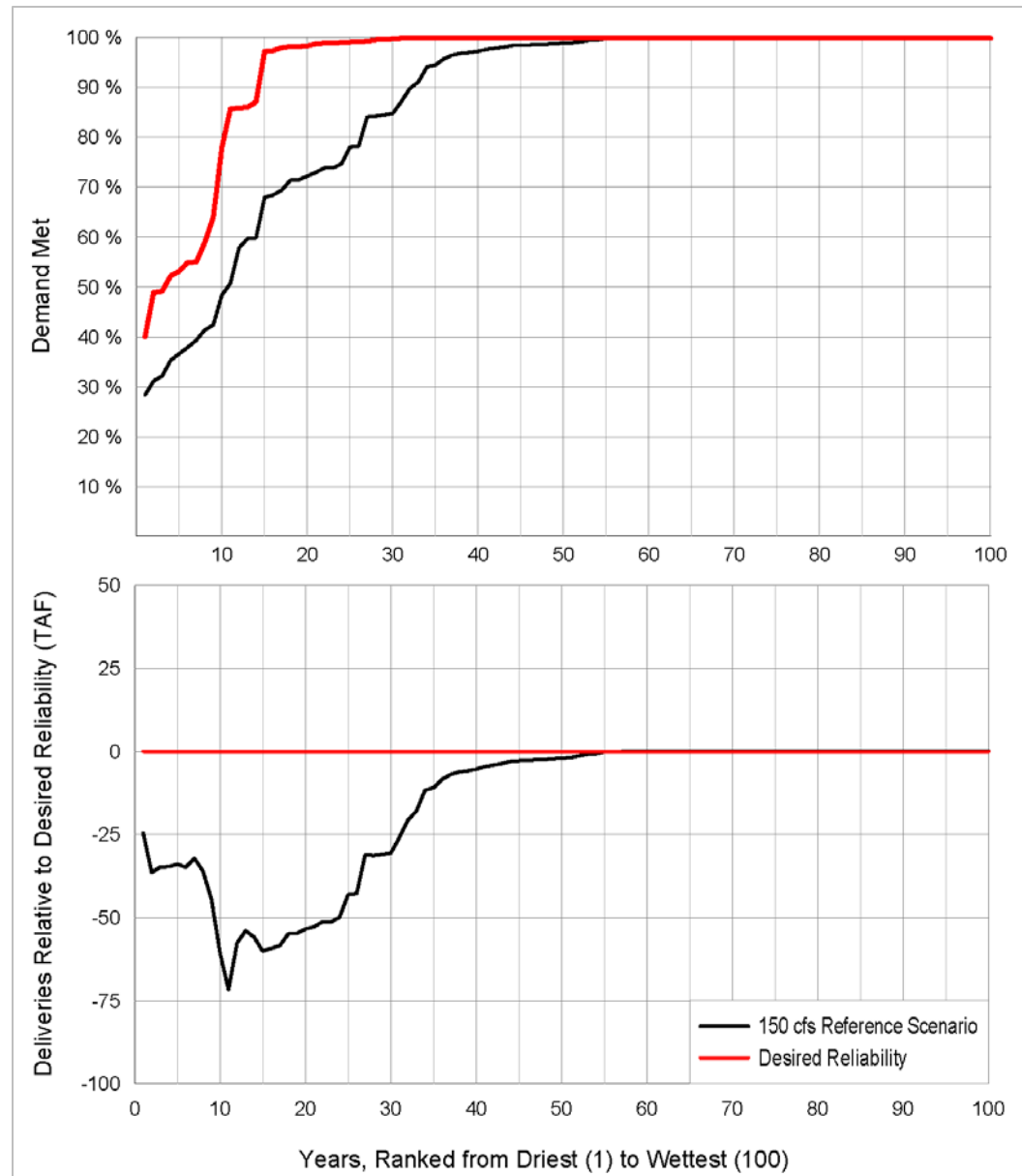


Figure 4-5. Relative Performance of Truckee Canal 250 cfs Flow-Stage Reference Scenarios on Annual Newlands Project Deliveries

Water Supply Conditions for the 150 cfs Reference Scenario

As demonstrated in Figure 4-6, the 150 cfs flow-stage reference scenario provides a level of reliability that only meets the Desired Reliability in 45 years of the 100 years evaluated. Reliability falls as much as 35 percent below the Desired Reliability condition for approximately 55 years of the 100 years evaluated. In the bottom graph, with the total delivery volume under the Desired Reliability as a baseline, the 150 cfs reference scenario results in a net shortage of 1,519,000 acre-feet over the period of evaluation.



Key: cfs = cubic feet per second; TAF = thousand acre-feet

Figure 4-6. Relative Performance of Truckee Canal 150 cfs Flow-Stage Reference Scenarios on Annual Newlands Project Deliveries

Water Supply Conditions for the 0 cfs Reference Scenario

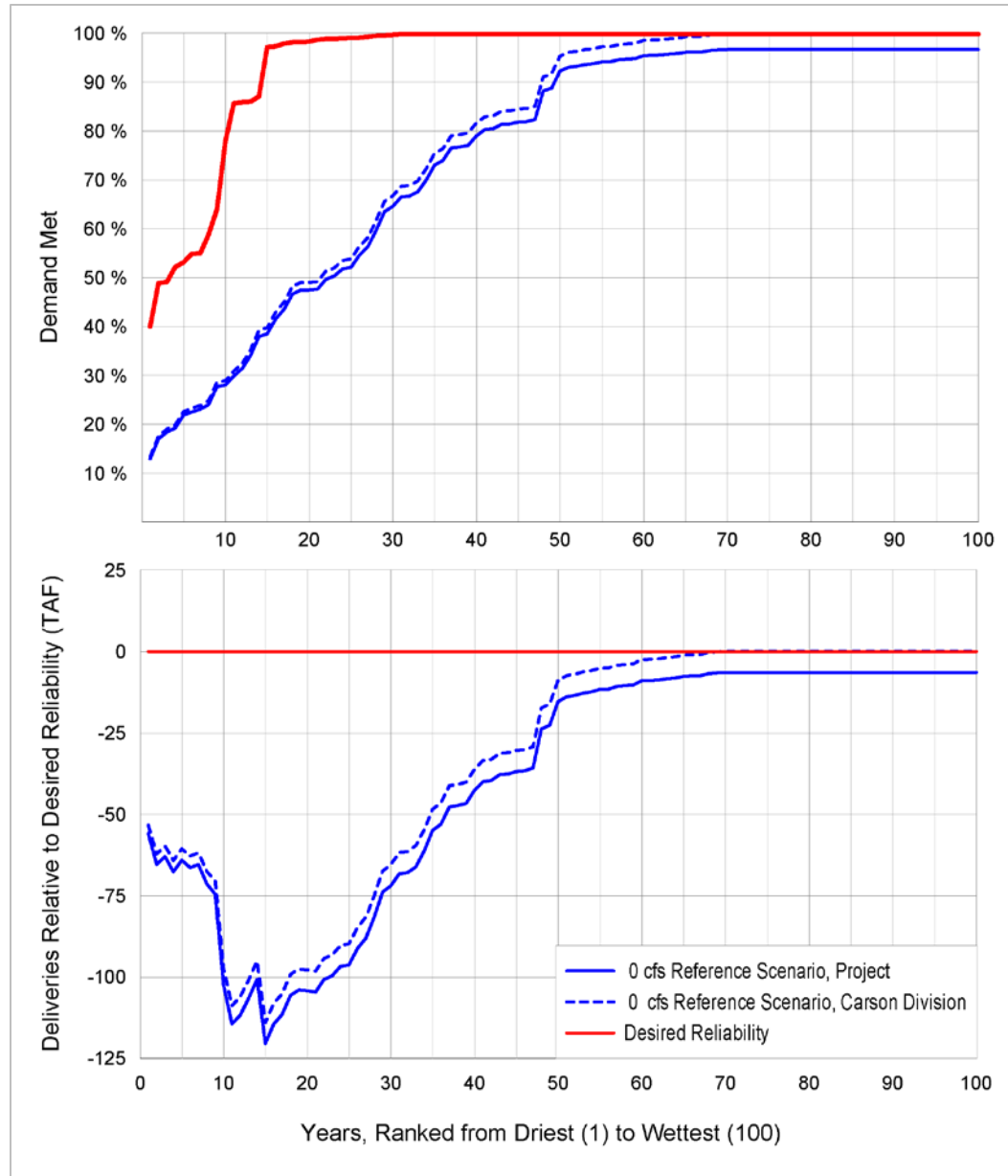
In contrast to the previous 4 figures, the graphs shown below (Figure 4-7) for the 0 cfs reference scenario consider both the Newlands Project (solid line) and, separately, the Carson Division (dashed line) in examining water supply reliability. This is because the 0 cfs scenario assumes decommissioning of the Truckee Canal, in which case demand would never be met in the Truckee Division.

However, even with the decommissioning of the Truckee Canal, the Carson Division would still receive water supply from the Carson River. The analysis of the performance of the Carson Division-only 0 cfs reference scenario, therefore, considers only the reliability of the Carson Division.

The Desired Reliability curves for the entire Project and for the Carson Division are nearly identical; as such, and to avoid confusion, the Desired Reliability does not change for Figure 4-7, and is the same curve used throughout the Study.

For the Truckee Division, the 0 cfs reference scenario meets 95 percent of the demand in 40 of the 100 years evaluated. The 3 percent gap between the Desired Reliability and the Project-wide 0 cfs reference scenario curves, even during the wettest years, represents Truckee Division's unmet demand due to the loss of the Truckee Canal. Consequently, an alternative source or delivery system will be included for the Truckee Division under any 0 cfs flow-stage alternative developed for this Study.

For the Carson Division, the 0 cfs flow-stage reference scenario provides a level of reliability that falls well below the Desired Reliability scenario for all but about 35 years of the 100 years evaluated. Reliability falls as much as 57 percent below the Desired Reliability for approximately 65 of the 100 years evaluated. In the bottom graph, with the total delivery volume under the Desired Reliability as a baseline, the 0 cfs reference scenario results in a net shortage of 3,344,000 acre-feet over the period of evaluation.

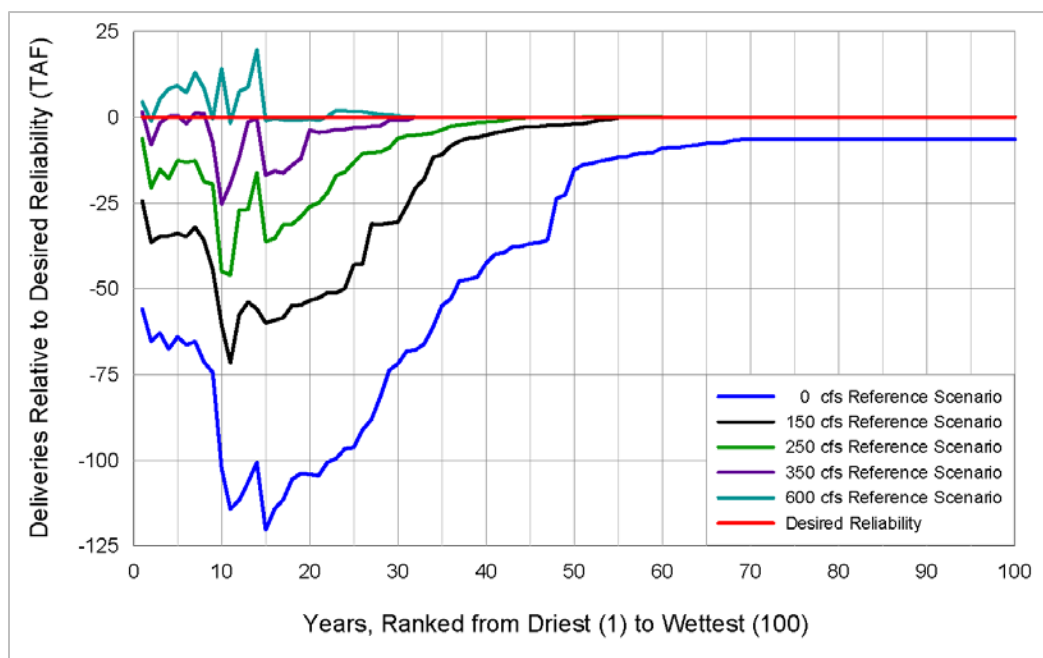


Key: cfs = cubic feet per second; TAF = thousand acre-feet

Figure 4-7. Relative Performance of Truckee Canal 0 cfs Flow-Stage Reference Scenarios on Annual Project Deliveries

Effectiveness of Measures Retained for Meeting Water Supply Objective

Preliminary alternatives were designed based upon the extent of remaining water supply improvement needed for a given flow-stage condition and by the extent of water supply improvement offered by the various measures retained after screening. Figure 4-8 illustrates the differences in annual water supply volumes between the Desired Reliability scenario and the range of Truckee Canal flow-stage reference scenarios, which represents the remaining water supply need under those conditions.



Key: cfs = cubic feet per second; TAF = thousand acre-feet

Figure 4-8. Summary of Differences Between the Desired Reliability and Reference Scenarios, Expressed in Volume

The following sections characterize the water supply benefits for the 11 measures retained and used in the development of preliminary alternatives. The characterization of these measures is organized by the subcategory for each measure.

Measures that Reduce Seepage Losses from the Truckee Canal

Two measures were retained from the subcategory “Reduce Truckee Division Seepage”: canal lining (“Line Truckee Canal”) and compaction (“Compact Soil Lining of the Truckee Canal”). Neither of these would completely eliminate losses from the Truckee Canal, but a significant reduction would be expected in portions of the canal where the soil was lined with concrete or compacted. As such, the evaluation of these measures for preliminary alternatives assumed that losses from the Truckee Canal would be reduced by 85 percent for lining and compaction (see Appendix D2).

For flow stages of 350 and 250 cfs, the measure available for reducing seepage from the Truckee Canal involves selecting the safety measure that implements a concrete liner for the Truckee Canal. For 350 cfs, the reduction of losses from the Truckee Canal appears to satisfy the water supply objective and result in a level of reliability that is equivalent to the Desired Reliability scenario. The reduction of losses brings 250 cfs closer to the Desired Reliability level, but it is still below the level of reliability for the 350 cfs reference scenario without lining.

For a flow stage of 150 cfs, the measure available for reduction of seepage losses on the Truckee Canal involves compacting the earthen embankments. The compaction measure improves Project water supply conditions for a flow stage of 150 cfs, but does not meet the Study's water supply objective.

Measures that Supply the Truckee Division

Two measures were retained from the subcategories "Establish New Truckee Division Points of Diversion and Delivery" and "Supplement Truckee Division Supply" to be used in combination with any measures that significantly reduce or eliminate seepage from the Truckee Canal or decommission all or most of the Truckee Canal from use. The retained measures include:

- Construction of a pipeline from the TC-1 takeout or from a direct Truckee River diversion along the length of the Truckee Canal through to Swingle Bench and Hazen, for serving Truckee Division agricultural water rights ("Construct Pipeline to Agricultural Users")
- Treatment of wastewater from the City of Fernley to a standard appropriate for serving Truckee Division agricultural water rights ("Treat Effluent and Deliver for Agricultural Use")

Construction of a pipeline along the length of the existing Truckee Canal right-of-way would be required for supplying Truckee Division agricultural rights for the 0 cfs flow-stage condition.

The treatment of City of Fernley wastewater could provide 1.5 million gallons per day, or 1,700 acre-feet per year of water supply. This would reduce demand for agricultural diversions in the Truckee Division by 26 percent, thereby reducing the size and operating costs of an on-river pump station. Depending on the intended application of the wastewater, upgrades could be required to the wastewater treatment plant.

Measures that Reduce Agricultural Demand Temporarily or Permanently

Three measures with similar performance characteristics were retained for the category "Reduce Agricultural Demand." These range from temporary dry-year demand reduction programs ("Crop Insurance/Fallowing" and "Partial Season Forbearance Agreements") to permanent water right retirement ("Acquire and Retire Water Rights"). All three have been evaluated with the same technical

approach that can be applied both to temporary and permanent demand reduction programs (see Appendix D3). Dry year reduction programs, however, were assumed to be limited to reducing 30 percent of Project demands; reductions in demand above 30 percent would require permanent water right retirement.

The estimated proportion of demand reductions needed to match demand to the available water supply (or meet the water supply objective) under a range of flow-stage conditions are based on an analysis that was formulated to test the broad effects of demand reduction (see Appendix D3) on Project reliability. The large increments of demand considered do not lend themselves to precise recommendations for how much demand must be reduced to meet water supply under specific circumstances, particularly if demand reduction measures are combined with other types of measures to form alternatives. Thus, a range of potential demand reductions has been identified for consideration in preliminary alternatives, as shown in Table 4-5.

Table 4-5. Estimated Reduction in Project Demand Required to Fulfill the Water Supply Objective

| Flow-Stage Condition | Required Reduction in Project Demand to Meet the Water Supply Objective Without Other Measures |
|-----------------------------|---|
| 600 cfs | 0% |
| 350 cfs | 5 – 15 % |
| 250 cfs | 20 – 25% |
| 150 cfs | 35 – 45% |
| 0 cfs (Carson Division) | 70 – 80% |
| 0 cfs (Truckee Division) | 100% |

Source: Appendix D3, "Effects of Reducing Demand on Newlands Project Water Supply."

Key:

cfs = cubic-foot per second

Demand reduction programs are measures that can be scaled up or down, as needed, and used alone or in conjunction with other measures to bring Project reliability closer to the Desired Reliability level at every flow stage. However, as these measures are dependent on willing participation, it may not be possible to provide a certain estimate for the degree of implementation that would occur.

Measures that Increase Conveyance Efficiency of the Carson Division

Two measures were retained from the subcategory for "Reduce Carson Division Seepage": canal lining and compaction. The potential extents of these measures in the Carson Division were developed as part of the Efficiency Study and are included in Table 4-4 (Reclamation 1994).

Lining and compaction differ in cost, performance, and maintenance requirements. Lining is more expensive, but also more durable; compaction was assumed to require frequent maintenance, but may be less expensive. The performance characteristics of these two measures would likely differ, requiring

potentially larger implementation of the compaction measure (Option 1 Expanded plus T Canal, instead of Option 1 Expanded) to achieve the highest benefit. Both measures, however, have the potential to increase Project efficiency.

The evaluation of these measures for preliminary alternatives assumed the outcome of their implementation to result in a Project efficiency of 75 percent (see Appendix D4). This is based on the achievements of the Efficiency Study recommendations and on the current and expected future characteristics of the Project. Two basic alternatives were recommended in the Efficiency Study, each with its own blend of the following actions that would bring the Project to an estimated 75 percent efficiency: water rights retirement and/or transfers, large improvements in flow measurement and metering, and canal lining. Since that study was completed, multiple programs have succeeded in retiring around 10,000 acres of Project water rights; about 9,500 acres of water rights have been transferred to wetlands use, which receives a reduced duty (see Appendix C); and, by the end of 2012, flow measurement devices will have been installed that accurately measure 75 percent of the Project's delivery volume (TCID 2010; Rusty Jardine and Walt Winder, TCID, personal communications, August 23, 2011, and February 9, 2012). Given this progress on the Efficiency Study's recommendations, this Study assumes that the conveyance efficiency improvements in the Carson Division would help the Project achieve 75 percent efficiency.

For a flow stage of 350 cfs, increasing Project conveyance efficiency to 75 percent through lining or compaction would achieve a level of reliability that far surpasses the Desired Reliability; for a 250 cfs flow stage, reliability is roughly equivalent to the Desired Reliability. For a flow stage of 150 cfs, it substantially improves Project water supply conditions, but does not fully meet the water supply objective. The remaining portion of water supply has a frequency and magnitude similar to the 250 cfs flow-stage reference scenario. For a flow stage of 0 cfs, increasing Project efficiency to 75 percent improves Project water supply conditions by up to 20 percent in some years, but does not fully meet the water supply objective, and significant water supply shortages would remain.

Measures that Develop Alternative Sources of Supply for the Carson Division

The only measure from the "Supplement Carson Division Supply" subcategory, a measure to import Dixie Valley groundwater, was retained. Dixie Valley, if developed, would supply an estimated 35,000 acre-feet of supply per year, which would meet about 16 percent of the anticipated maximum annual Project demand in the future. The effect of this measure would be similar to removing 10 – 13 percent of the demand from the Newlands Project, depending on the efficiency of delivery to water rights holders. For simplicity in the construction of preliminary alternatives, Dixie Valley was assumed to have the same effect as reducing Project demand by 10 percent.

Preliminary Alternatives

During the planning process, alternatives often go through multiple phases iterations before reaching their final form. Many planning studies develop and evaluate alternatives with the express goal of producing and recommending one preferred alternative among several considered. In contrast to such an approach, this Study's intent is not to conclude by selecting one alternative among a range of options that have varying features and costs. This Study's goal is to formulate a range of alternatives, based on a range of Truckee Canal flow stages, that each achieve the Study objectives of safety and water supply reliability. As a result, this Study approached alternatives formulation by first developing preliminary alternatives containing all of the water supply measures that are effective or compatible with different Truckee Canal flow stages and identifying the most effective measures before the alternatives are assembled. This section of Chapter 4 describes the preliminary alternatives developed for all Truckee Canal flow stages: 600, 350, 250, 150, and 0 cfs.

As noted previously, the screening process for the water supply measures provided the basis for pairing specific measures with a range of Truckee Canal flow stages and related methods for achieving the Study's safety objective. While each preliminary alternative described below includes a list of the water supply measures considered to be compatible with a particular flow stage, not all of the measures will necessarily be included in the alternatives.

Summary of Preliminary Alternatives

Using the safety measures and water supply measures identified previously in this chapter, the Study assembled a total of 24 preliminary alternatives for the range of Truckee Canal flow stages. Figure 4-9 illustrates how measures from various subcategories were combined to reach the Desired Reliability. For each flow stage, the preliminary alternatives are presented in the same sequence and order as they are described in the following pages.

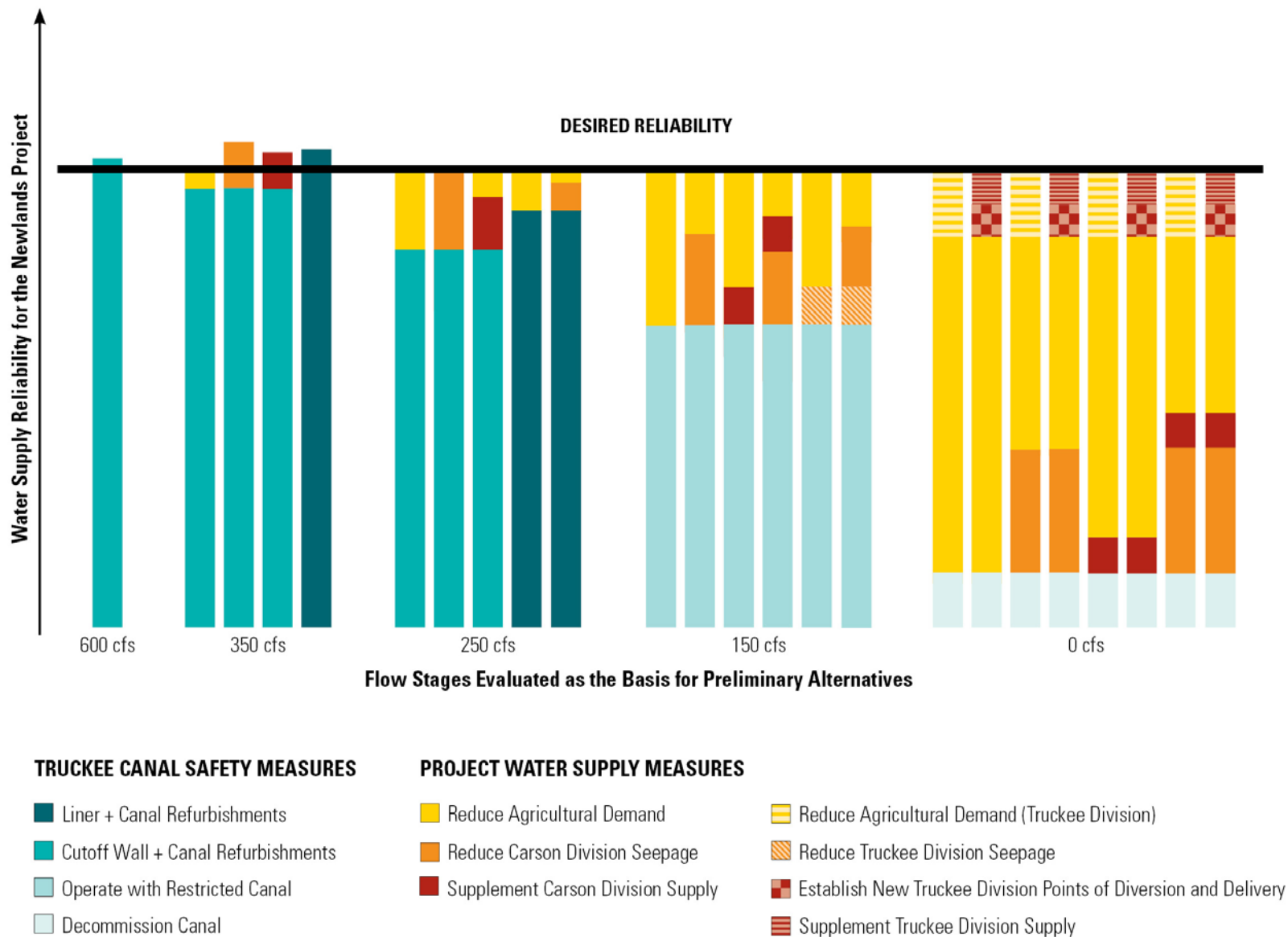


Figure 4-9. Summary of Preliminary Alternatives Assembled to Achieve Safety and Water Supply Reliability

The tables that follow (Tables 4-6 through 4-8) summarize information that is developed in greater detail later in this chapter, but also provided here for quick cross-comparison. They include the following about each preliminary alternative:

- The assumed canal capacity (flow stage)
- The measure selected for meeting the safety objective, differentiated by the options for providing structural integrity improvements along the canal (e.g., concrete lining, HDPE cutoff wall)
- The primary measure selected for meeting the water supply objective. For each preliminary alternative, this measure was applied to its maximum extent before relying on additional measures for meeting the water supply objective
- Any additional measures selected for meeting the water supply objective
- Initial estimates of the field cost for each alternative, including the potential high and low range of costs

Table 4-6 summarizes the blend of measures in each of the preliminary alternatives developed for flow stages of 600, 350, 250, and 150 cfs; it does not include preliminary alternatives for the 0 cfs flow stage. The complexity of meeting the water supply objective for the 0 cfs flow stage required that the Carson and Truckee divisions be considered separately. Table 4-7 presents components of preliminary alternatives developed for meeting the water supply objective for each division, independently, at the 0 cfs flow stage. Finally, Table 4-8 shows these components combined into preliminary alternatives that meet the water supply objective for both divisions under a 0 cfs flow-stage condition.

Table 4-6. Summary of Preliminary Alternatives between Flow Stages of 600 cfs and 150 cfs

| Truckee Canal Flow Stage | | Measures Selected to Meet Objectives | | | Est. Annual Cost (\$ Million) ^{1,2} | |
|-----------------------------|---|--------------------------------------|--|--|--|---------|
| | | Safety | Water Supply | | Low | High |
| | | | Primary Measure | Additional Measure(s) | | |
| 600 cfs | | HDPE Cutoff Wall | None | | \$2.10 | \$2.10 |
| 350 cfs | a | HDPE Cutoff Wall | Reduce Agricultural Demand (5 to 15%, 2 measures) | None | \$2.50 | \$3.90 |
| | b | | Reduce Carson Division Seepage (2 measures) | None | \$2.60 | \$10.00 |
| | c | | Supplement Carson Division (1 measure) | None | \$6.50 | \$13.00 |
| | d | Concrete/ Geomembrane Liner | None | | \$2.80 | \$2.80 |
| 250 cfs | a | HDPE Cutoff Wall | Reduce Agricultural Demand (20 to 25%, 2 measures) | None | \$3.70 | \$5.10 |
| | b | | Reduce Carson Division Seepage (2 measures) | None | \$2.60 | \$10.00 |
| | c | | Supplement Carson Division Supply (1 measure) | Reduce Agricultural Demand (10 to 15%, 2 measures) | \$7.30 | \$15.00 |
| | d | Concrete/ Geomembrane Liner | Reduce Agricultural Demand (10 to 15%, 2 measures) | None | \$3.60 | \$5.20 |
| | e | | Reduce Carson Division Seepage (2 measures) | Reduce Agricultural Demand (0 to 10%, 2 measures) | \$3.30 | \$5.10 |

Table 4-6. Summary of Preliminary Alternatives between Flow Stages of 600 cfs and 150 cfs (contd.)

| Truckee Canal Flow Stage | | Measures Selected to Meet Objectives | | | | Est. Annual Cost (\$ Million) ^{1,2} | |
|--------------------------|---|---------------------------------------|--|--|--|--|---------|
| | | Safety | Water Supply | | | Low | High |
| | | | Primary Measure | Additional Measure(s) | | | |
| 150 cfs | a | Maintain Flows at or Below Flow Stage | Reduce Agricultural Demand (35 to 45%, 2 measures) | None | | \$2.90 | \$5.30 |
| | b | | Reduce Carson Division Seepage (2 measures) | Reduce Agricultural Demand (15 to 25%, 2 measures) | | \$1.70 | \$11.00 |
| | c | | Supplement Carson Division Supply (1 measure) | Reduce Agricultural Demand (25 to 35%, 2 measures) | | \$6.40 | \$15.00 |
| | d | | Reduce Carson Division Seepage (2 measures) | Supplement Carson Division Supply(1 measure) | Reduce Agricultural Demand (0 to 25%, 2 measures) | \$4.90 | \$22.00 |
| | e | | Reduce Truckee Division Seepage (1 measure) | Reduce Agricultural Demand (25 to 40%, 2 measures) | | \$2.20 | \$4.90 |
| | f | | Reduce Truckee Division Seepage (1 measure) | Reduce Carson Division Seepage (2 measures) | Reduce Agricultural Demand (15 to 30%, 2 measures) | \$1.90 | \$12.00 |

Notes:

¹ Cost estimates have been formatted to indicate the annual cost of implementing each preliminary alternative, relative to the full range of costs developed for preliminary alternatives. Green represents lower costs (lowest being \$1.7 million), red represents higher costs (highest being \$22 million), and yellow represents mid-range costs.

² Annual costs include interest and amortization of the field cost based on the current Federal discount rate of 4 percent, over an assumed service life of the measures included (from 5 to 65 years depending on the specific measure). See Appendix E2 for additional information.

Key:

cfs = cubic feet per second

HDPE = High Density Polyethylene

Table 4-7. Components of 0 cfs Preliminary Alternatives by Division

| Focus of Component | | Measures to Meet the Water Supply Objective | | Est. Annual Cost (\$ Million) ¹ | |
|--------------------|---|--|--|--|---------------------|
| | | Primary Measure | Additional Measure(s) | | Low High |
| Carson Division | a | Reduce Agricultural Demand (70 to 80%, 2 measures) | None | | \$5.60 \$10.00 |
| Carson Division | b | Reduce Carson Division Seepage (2 measures) | Reduce Agricultural Demand (60 to 70%, 2 measures) | | \$5.20 \$15.00 |
| Carson Division | c | Supplement Carson Division Supply (1 measure) | Reduce Agricultural Demand (60 to 70%, 2 measures) | | \$9.10 \$18.00 |
| Carson Division | d | Reduce Carson Division Seepage (2 measures) | Supplement Carson Division Supply (1 measure) | Reduce Agricultural Demand (50 to 60%, 2 measures) | \$8.80 \$25.00 |
| Truckee Division | y | Reduce Agricultural Demand (100%, 1 measure) | None | | \$1.00 \$1.00 |
| Truckee Division | z | Establish New Truckee Division Points of Diversion and Delivery (Agriculture, 1 measure) | Supplement Truckee Division Supply (2 measures) | | \$8.40 \$11.00 |

Notes:

¹ Annual costs include interest and amortization of the field cost based on the current Federal discount rate of 4 percent, over an assumed service life of the measures included (from 5 to 65 years depending on the specific measure). See Appendix E2 for additional information.

Key:

cfs = cubic feet per second

Table 4-8. Summary of Preliminary Alternatives for a Flow Stage of 0 cfs

| Truckee Canal Flow Stage | | Measures Selected to Meet Objectives | | | | Est. Annual Cost (\$ Million) ^{1,2} | |
|--------------------------|----|--------------------------------------|---------------------|----------------------|---------|--|-----|
| | | Safety | Water Supply | | | | |
| | | | Components Selected | | | | Low |
| 0 cfs | ay | Decommission Truckee Canal | Carson Division 0.a | Truckee Division 0.y | \$6.60 | \$11.00 | |
| | az | | | Truckee Division 0.z | \$14.00 | \$21.00 | |
| | by | | Carson Division 0.b | Truckee Division 0.y | \$6.20 | \$16.00 | |
| | bz | | | Truckee Division 0.z | \$13.60 | \$26.00 | |
| | cy | | Carson Division 0.c | Truckee Division 0.y | \$10.10 | \$19.00 | |
| | cz | | | Truckee Division 0.z | \$17.50 | \$29.00 | |
| | dy | | Carson Division 0.d | Truckee Division 0.y | \$9.80 | \$26.00 | |
| | dz | | | Truckee Division 0.z | \$17.20 | \$36.00 | |

Notes:

¹ Cost estimates have been formatted to indicate the annual cost of implementing each preliminary alternative, relative to the full range of costs developed for preliminary alternatives. Green represents lower costs (lowest being \$6.2 million), red represents higher costs (highest being \$36 million), and yellow represents mid-range costs.

² Annual costs include interest and amortization of the field cost based on the current Federal discount rate of 4 percent, over an assumed service life of the measures included (from 5 to 65 years depending on the specific measure). See Appendix E2 for additional information.

Key:

cfs = cubic feet per second

Preliminary Alternatives for the 600 cfs Flow Stage

One preliminary alternative was developed for meeting the Study objectives with a Truckee Canal flow stage of 600 cfs. This preliminary alternative relies upon a single measure for meeting the Study's safety objective, and the flow stage alone fully satisfies the Study's water supply objective, precluding the need for additional measures.

Table 4-9 shows the estimated cost, annually, for meeting both Study objectives at the 600 cfs flow stage. The following sections provide additional detail on the water supply needs at 600 cfs, and the rationale behind selecting measures to meet Study objectives.

Approaches for Meeting the Safety Objective at 600 cfs

Corrective actions that would satisfy the Study safety objective at 600 cfs include changes to O&M and structural features of the Truckee Canal. The lowest-cost approach – which relies in part upon an HDPE cutoff wall – was selected as the initial measure for developing a preliminary alternative that, at a minimum, meets the safety objective. However, full alternatives for the 600 cfs flow stage could consider whether the additional seepage reduction benefit provided by a concrete geomembrane liner is worth the additional cost that potential cost-share partners would incur (see Appendix D2 for a discussion of canal lining at different flow stages, including 600 cfs).

Approaches for Meeting the Water Supply Objective at 600 cfs

No additional measures are required to meet the water supply objective when the allowable flow stage in the Truckee Canal is 600 cfs.

Table 4-9. Measures Selected for Preliminary Alternatives with a 600 cfs Flow Stage

| Preliminary Alternative Name | Measure Selected for Safety Objective | Measures Available for Water Supply Objective | Estimated Costs (\$ Million, annual) ^{1,2} | |
|------------------------------|---------------------------------------|---|---|--------|
| | | | Low | High |
| 600.a | HDPE Cutoff Wall | | \$2.10 | \$2.10 |
| | | None | - | - |
| | Range of Total Costs (annual) | | \$2.10 | \$2.10 |

Notes:

Discrepancies may exist due to rounding (Reclamation Manual Directives and Standards FAC 09-01).

¹ Annual cost for each measure is discussed in Appendix E2.

² Annual costs include interest and amortization of the field cost based on the current Federal discount rate of 4 percent, over an assumed service life of the measures included (from 5 to 65 years depending on the specific measure).

Key:

HDPE = High Density Polyethylene

Preliminary Alternatives for the 350 cfs Flow Stage

Four preliminary alternatives were developed for meeting the Study objectives with a Truckee Canal flow stage of 350 cfs. These preliminary alternatives rely upon one of two measures for meeting the Study's safety objective, and combinations of up to three different measures for meeting the Study's water supply objective.

The estimated annual cost for meeting both Study objectives at the 350 cfs flow stage ranges between \$2.5 million and \$13 million, depending on the preliminary alternative selected. The following sections provide additional detail on the water supply needs at a flow stage of 350 cfs, and the rationale behind selecting measures to meet Study objectives.

Approaches for Meeting the Safety Objective at 350 cfs

Three preliminary alternatives (350.a, b, and c) rely on the lowest-cost measure for meeting the safety objective, which includes implementation of an HDPE cutoff wall.

One of the preliminary alternatives (350.d) relies on the highest-cost measure for meeting the safety objective, which includes implementation of a concrete liner and geomembrane along portions of the Truckee Canal as described previously. This measure reduces seepage along the Truckee Canal in a manner that contributes to the water supply objective, as discussed in the following section.

Approaches for Meeting the Water Supply Objective at 350 cfs

350.a Preliminary alternative 350.a meets the water supply objective through a 5 percent to 15 percent reduction in the Project's agricultural demand. The ability to meet the water supply objective with demand reductions is described in Appendix D3.

Preliminary alternative 350.a would include one of two measures from the "Reduce Agricultural Demand" category: one to acquire and permanently retire Project water rights, and another to reduce agricultural demand in dry years, such as through volunteer fallowing programs or partial season forbearance agreements.

350.b Preliminary alternative 350.b meets the water supply objective through increases in Project efficiency. The ability to meet the water supply objective with efficiency improvements is described in Appendix D4.

Preliminary alternative 350.b would include one of two measures from the "Reduce Carson Division Seepage" subcategory: lining or compacting the soil lining of the division's main conveyance features. Both have the potential to produce increases in Project efficiency that will meet the water supply objective. The range of estimated costs for these measures reflects unknowns in the extent of potential canal rehabilitation needed and differences in price

between the two approaches. If implemented, either of these may also reduce maintenance costs to TCID.

350.c Preliminary alternative 350.c meets the water supply objective through importing groundwater from Dixie Valley. The assessed yield of Dixie Valley (35,000 acre-feet per year) meets or exceeds the volume of water supply needs for the 350 cfs flow stage, as shown in Figure 4-4.

350.d Preliminary alternative 350.d meets most of the water supply objective through implementation of the safety measure that includes a concrete and geomembrane lining. This is assessed in Appendix D2.

Table 4-10 includes the estimated annual costs for the 350 cfs preliminary alternatives.

Table 4-10. Measures Selected for Preliminary Alternatives with a 350 cfs Flow Stage

| Preliminary Alternative Name | Measure Selected for Safety Objective | Measures Available for Water Supply Objective | Estimated Costs (\$ Million, annual) ^{1,2} | |
|------------------------------|---------------------------------------|---|---|----------------|
| | | | Low | High |
| 350.a | HDPE Cutoff Wall | | \$2.10 | \$2.10 |
| | | <u>Reduce Agricultural Demand (5 to 15%)</u> | | |
| | | Fallowing/Partial Season Agreements | \$0.39 | \$1.80 |
| | | Acquire and Retire Water Rights | \$0.45 | \$1.35 |
| | Range of Total Costs (annual) | | \$2.50 | \$3.90 |
| 350.b | HDPE Cutoff Wall | | \$2.10 | \$2.10 |
| | | <u>Reduce Carson Division Seepage (Increase Efficiency up to 75%)</u> | | |
| | | Compact the Soil Lining of Main Canals and Laterals | \$0.49 | \$1.05 |
| | | Line Main Canals and Laterals | \$8.00 | \$8.00 |
| | Range of Total Costs (annual) | | \$2.60 | \$10.00 |
| 350.c | HDPE Cutoff Wall | | \$2.10 | \$2.10 |
| | | <u>Supplement Carson Division Supply</u> | | |
| | | Import Dixie Valley Groundwater | \$4.40 | \$11.00 |
| | Range of Total Costs (annual) | | \$6.50 | \$13.00 |
| 350.d | Concrete/Geomembrane Lining | | \$2.80 | \$2.80 |
| | | None | | |
| | Range of Total Costs (annual) | | \$2.80 | \$2.80 |

Notes:

Discrepancies may exist due to rounding (Reclamation Manual Directives and Standards FAC 09-01).

¹ Annual cost for each measure is discussed in Appendix E2.

² Annual costs include interest and amortization of the field cost based on the current Federal discount rate of 4 percent, over an assumed service life of the measures included (from 5 to 65 years depending on the specific measure).

Key:

cfs = cubic feet per second

HDPE = High Density Polyethylene

Preliminary Alternatives for the 250 cfs Flow Stage

Five preliminary alternatives were developed for meeting the Study objectives with a Truckee Canal flow stage of 250 cfs. These preliminary alternatives rely upon two measures for meeting the Study's safety objective, and a number of combinations of measures for meeting the Study's water supply objective.

The estimated annual cost for meeting both Study objectives at the 250 cfs flow stage is between \$2.6 million and \$15 million, depending on the preliminary alternative selected. The following sections provide additional detail on the water supply needs at a flow stage of 250 cfs, and the rationale behind selecting measures to meet Study objectives.

Approaches for Meeting the Safety Objective at 250 cfs

Three preliminary alternatives (250.a, b, and c) rely on the lowest-cost measure for meeting the safety objective, which includes implementation of an HDPE cutoff wall.

Two of the preliminary alternatives (250.d and 250.e) rely upon the highest-cost measure for meeting the safety objective, which includes implementation of a concrete liner and geomembrane along portions of the Truckee Canal, as described previously. This measure reduces seepage along the Truckee Canal, which also contributes to the water supply objective, but does not fully meet it.

Approaches for Meeting the Water Supply Objective at 250 cfs

250.a Preliminary alternative 250.a meets the water supply objective through reductions in the Project's agricultural demand. The ability to meet the water supply objective with demand reductions is described in Appendix D3.

Preliminary alternative 250.a would include one of two measures from the "Reduce Agricultural Demand" category: one to acquire and permanently retire Project water rights, and another to reduce agricultural demand in dry years, such as through volunteer fallowing programs or partial season forbearance agreements. These measures would aim to reduce Project agricultural demand by 20 percent to 25 percent.

250.b Preliminary alternative 250.b meets the water supply objective through increases in Project efficiency. The ability to meet the water supply objective with efficiency improvements is described in Appendix D4.

As with preliminary alternative 350.b, 250.b would include one of two measures from the "Reduce Carson Division Seepage" subcategory: lining or compacting the soil lining of the division's main conveyance features. Both have the potential to produce increases in Project efficiency that will meet the water supply objective. The range of estimated costs for these measures reflects unknowns in the extent of potential canal rehabilitation needed and differences in price between the two approaches. If implemented, either of these may also reduce maintenance costs to TCID.

250.c Preliminary alternative 250.c meets the water supply objective through the importation of Dixie Valley groundwater and reductions in Project agricultural demand. The ability to meet the water supply objective by reducing demand is described in Appendix D3.

The assessed yield of Dixie Valley (35,000 acre-feet per year) meets a significant portion of the water supply needs under the 250 cfs flow stage. However, meeting the water supply objective requires obtaining more than this volume for a large number of years.

To address the unmet demand that is not fully eliminated by Dixie Valley supplies, preliminary alternative 250.c would also include at least one of two

measures from the “Reduce Agricultural Demand” category. These measures would aim to reduce demand by 10 to 15 percent.

250.d Preliminary alternative 250.d meets some of the water supply objective through implementation of the safety measure that includes a concrete and geomembrane lining. This is assessed in Appendix D2.

Additionally, to address the unmet demand still remaining, 250.d would also include at least one of two measures from the “Reduce Agricultural Demand” category. These measures would aim to reduce demand by 10 to 20 percent.

250.e As with 250.d, preliminary alternative 250.e meets some of the water supply objective through implementation of the safety measure that includes a concrete and geomembrane lining. This is assessed in Appendix D2.

As with preliminary alternative 250.b, 250.e would include one of two measures from the “Reduce Carson Division Seepage” subcategory: lining or compacting the soil lining of the division’s main conveyance features.

Additionally, to address the unmet demand still remaining, 250.e would include at least one of two measures from the “Reduce Agricultural Demand” category. These measures would aim to reduce demand by up to 10 percent.

Table 4-11 includes the estimated annual costs for the 250 cfs preliminary alternatives.

Table 4-11. Measures Selected for Preliminary Alternatives with a 250 cfs Flow Stage

| Preliminary Alternative Name | Measure Selected for Safety Objective | Measures Available for Water Supply Objective | Estimated Costs (\$ Million, annual) ^{1,2} | |
|------------------------------|---------------------------------------|---|---|----------------|
| | | | Low | High |
| 250.a | HDPE Cutoff Wall | | \$2.10 | \$2.10 |
| | | <u>Reduce Agricultural Demand (20 to 25%)</u> | | |
| | | Fallowing/Partial Season Agreements | \$1.60 | \$3.00 |
| | | Acquire and Retire Water Rights | \$1.80 | \$2.20 |
| | Range of Total Costs (annual) | | \$3.70 | \$5.10 |
| 250.b | HDPE Cutoff Wall | | \$2.10 | \$2.10 |
| | | <u>Reduce Carson Division Seepage (Increase Efficiency up to 75%)</u> | | |
| | | Compact the Soil Lining of Main Canals and Laterals | \$0.49 | \$1.05 |
| | | Line Main Canals and Laterals | \$8.00 | \$8.00 |
| | Range of Total Costs (annual) | | \$2.60 | \$10.00 |
| 250.c | HDPE Cutoff Wall | | \$2.10 | \$2.10 |
| | | <u>Supplement Carson Division Supply</u> | | |
| | | Import Dixie Valley Groundwater | \$4.40 | \$11.00 |
| | | <u>Reduce Agricultural Demand (10 to 15%)</u> | | |
| | | Fallowing/Partial Season Agreements | \$0.79 | \$1.80 |
| | | Acquire and Retire Water Rights | \$0.90 | \$1.35 |
| | Range of Total Costs (annual) | | \$7.30 | \$15.00 |
| 250.d | Concrete/Geomembrane Lining | | \$2.80 | \$2.80 |
| | | <u>Reduce Agricultural Demand (10 to 20%)</u> | | |
| | | Fallowing/Partial Season Agreements | \$0.79 | \$2.40 |
| | | Acquire and Retire Water Rights | \$0.90 | \$1.80 |
| | Range of Total Costs (annual) | | \$3.60 | \$5.20 |

Table 4-11. Measures Selected for Preliminary Alternatives with a 250 cfs Flow Stage (contd.)

| Preliminary Alternative Name | Measure Selected for Safety Objective | Measures Available for Water Supply Objective | Estimated Costs (\$ Million, annual) ^{1,2} | |
|------------------------------|---------------------------------------|---|---|---------------|
| | | | Low | High |
| 250.e | Concrete/Geomembrane Lining | | \$2.80 | \$2.80 |
| | | <u>Reduce Carson Division Seepage (Increase Efficiency up to 75%)</u> | | |
| | | Compact the Soil Lining of Main Canals and Laterals | \$0.49 | \$1.05 |
| | | Line Main Canals and Laterals | \$8.00 | \$8.00 |
| | | <u>Reduce Agricultural Demand (0 to 10%)</u> | | |
| | | Fallowing/Partial Season Agreements | \$0.00 | \$1.20 |
| | | Acquire and Retire Water Rights | \$0.00 | \$0.90 |
| | Range of Total Costs (annual) | | \$3.30 | \$5.10 |

Notes:

Discrepancies may exist due to rounding (Reclamation Manual Directives and Standards FAC 09-01).

¹ Annual cost for each measure is discussed in Appendix E2.

² Annual costs include interest and amortization of the field cost based on the current Federal discount rate of 4 percent, over an assumed service life of the measures included (from 5 to 65 years depending on the specific measure).

Key:

cfs = cubic feet per second

HDPE = High Density Polyethylene

Preliminary Alternatives for the 150 cfs Flow Stage

Six preliminary alternatives were developed for meeting the Study objectives with a Truckee Canal flow stage of 150 cfs. These preliminary alternatives build upon the assumed future condition of the Truckee Canal, where capacity has been restricted to flow stages that do not exceed 150 cfs.

The estimated annual cost for meeting both Study objectives at the 150 cfs flow stage is between \$1.7 million and \$22 million, depending on the preliminary alternative selected. The following sections provide additional detail on the water supply needs at a flow stage of 150 cfs, and the rationale behind selecting measures to meet Study objectives.

Approaches for Meeting the Safety Objective at 150 cfs

Reclamation considers a flow stage of 150 cfs in the Truckee Canal, in combination with other revisions to O&M and ongoing structural repair projects, to meet the safety objective of the Study. As described in Chapter 3, the 150 cfs flow stage is considered to be the likely future condition for the Truckee Canal, absent more comprehensive structural repairs.

Approaches for Meeting the Water Supply Objective at 150 cfs

150.a Preliminary alternative 150.a meets the water supply objective through 35 percent to 45 percent reduction in the Project’s agricultural demand. The ability to meet the water supply objective with demand reductions is described in Appendix D3.

Preliminary alternative 150.a would include one of two measures from the “Reduce Agricultural Demand” category: one to acquire and permanently retire Project water rights, and another to reduce agricultural demand in dry years, such as through volunteer fallowing programs or partial season forbearance agreements. As the implementation of dry-year demand reduction programs are likely limited to no more than 30 percent of the Project, at least 5 percent of the water rights would need to be permanently retired.

150.b Preliminary alternative 150.b meets the water supply objective through increases in Project efficiency and reductions in Project agricultural demand.

As with preliminary alternative 250.b, 150.b would include one of two measures from the “Reduce Carson Division Seepage” subcategory: lining or compacting the soil lining of the division’s main conveyance features. Both have the potential to produce increases in Project efficiency that will make large contributions to meeting the water supply objective. The range of estimated costs for these measures reflects unknowns in the extent of potential canal rehabilitation needed and differences in price between the two approaches. If implemented, either of these may also reduce maintenance costs to TCID.

Preliminary alternative 150.b would also include one of two measures from the “Reduce Agricultural Demand” category: one to acquire and permanently retire Project water rights, and another to reduce agricultural demand in dry years, such as through volunteer fallowing programs or partial season forbearance agreements. These measures would aim to reduce Project agricultural demand by 15 percent to 25 percent. Both measures contribute equally to the Study’s water supply objective.

150.c Preliminary alternative 150.c meets the water supply objective through the importation of Dixie Valley groundwater and reductions in Project agricultural demand.

The assessed yield of Dixie Valley (35,000 acre-feet per year) meets a significant portion of the water supply needs under the 150 cfs flow stage. However, meeting the water supply objective requires obtaining more than this volume for a large number of years.

To address the unmet demand that is not fully eliminated by Dixie Valley supplies, preliminary alternative 150.c would also include at least one of two measures from the “Reduce Agricultural Demand” category. These measures would aim to reduce Project agricultural demand by 25 percent to 35 percent.

As the implementation of dry-year demand reduction programs are likely limited to no more than 30 percent of the Project, up to 5 percent of the water rights may need to be permanently retired.

150.d Preliminary alternative 150.d meets the water supply objective through implementation of three actions: (1) increases in Project efficiency, (2) importation of Dixie Valley groundwater, and (3) reductions in Project agricultural demand. The ability to meet the water supply objective with demand reductions and efficiency improvements is described in Appendix D3 and Appendix D4, respectively.

Preliminary alternative 150.d would include one of two measures from the “Reduce Carson Division Seepage” subcategory: lining or compacting the soil lining of the division’s main conveyance features. Both have the potential to produce increases in Project efficiency that will make large contributions to meeting the water supply objective. The range of estimated costs for these measures reflects unknowns in the extent of potential canal rehabilitation needed and differences in price between the two approaches. If implemented, either of these may also reduce maintenance costs to TCID.

The assessed yield of Dixie Valley (35,000 acre-feet per year) meets a significant portion of the water supply needs under the 150 cfs flow stage. However, meeting the water supply objective requires obtaining more than this volume for a large number of years. To address the unmet demand that is not fully eliminated by Dixie Valley supplies and increased efficiency, preliminary alternative 150.d would also include at least one of two measures from the “Reduce Agricultural Demand” category. These measures would aim to reduce Project agricultural demand by up to 25 percent.

150.e Preliminary alternative 150.e meets the water supply objective through implementation of two actions: (1) reduction of seepage losses from the Truckee Canal and (2) reductions in Project agricultural demand. The ability to meet the water supply objective through seepage reductions on the Truckee Canal and through reductions in demand is described in Appendix D2 and Appendix D3, respectively.

Preliminary alternative 150.e relies on compaction of the earthen embankment along the Truckee Canal to reduce seepage losses.

Preliminary alternative 150.e would include at least one of two measures from the “Reduce Agricultural Demand” category. These measures would aim to reduce Project agricultural demand by 25 percent to 40 percent. As the implementation of dry-year demand reduction programs are likely limited to no more than 30 percent of the Project, up to 10 percent of the water rights may need to be permanently retired.

150.f Preliminary alternative 150.f meets the water supply objective through implementation of three actions: (1) reduction of seepage losses from the Truckee Canal (Appendix D2), (2) increases in Project efficiency (Appendix D4), and (3) reduction in Project agricultural demand (Appendix D3).

Preliminary alternative 150.f relies on compaction of the earthen embankment along the Truckee Canal to reduce seepage losses. .

Preliminary alternative 150.f would also include one of two measures from the “Reduce Carson Division Seepage” subcategory: lining or compacting the soil lining of the division’s main conveyance features.

Additionally, to address the unmet demand still remaining, preliminary alternative 150.f would include at least one of two measures from the “Reduce Agricultural Demand” category. These measures would aim to reduce Project agricultural demand by 15 percent to 30 percent. Table 4-12 includes the estimated annual costs for the 150 cfs preliminary alternatives.

Table 4-12. Measures Selected for Preliminary Alternatives with a 150 cfs Flow Stage

| Preliminary Alternative Name | Measure Selected for Safety Objective | Measures Available for Water Supply Objective | Estimated Costs (\$ Million, annual) ^{1,2} | |
|------------------------------|---------------------------------------|---|---|----------------|
| | | | Low | High |
| 150.a | Operate at 150 cfs | | \$0.02 | \$0.02 |
| | | <u>Reduce Agricultural Demand (35 to 45%)</u> | | |
| | | Following/Partial Season Agreements (up to 30%) | \$2.90 | \$5.30 |
| | | Acquire and Retire Water Rights (up to 45%) | | |
| | Range of Total Costs (annual) | | \$2.90 | \$5.30 |
| 150.b | Operate at 150 cfs | | \$0.02 | \$0.02 |
| | | <u>Reduce Carson Division Seepage (Increase Efficiency up to 75%)</u> | | |
| | | Compact the Soil Lining of Main Canals and Laterals | \$0.49 | \$1.05 |
| | | Line Main Canals and Laterals | \$8.00 | \$8.00 |
| | | <u>Reduce Agricultural Demand (15 to 25%)</u> | | |
| | | Following/Partial Season Agreements | \$1.20 | \$3.00 |
| | | Acquire and Retire Water Rights | \$1.35 | \$2.20 |
| | Range of Total Costs (annual) | | \$1.70 | \$11.00 |
| 150.c | Operate at 150 cfs | | \$0.02 | \$0.02 |
| | | <u>Supplement Carson Division Supply</u> | | |
| | | Import Dixie Valley Groundwater | \$4.40 | \$11.00 |
| | | <u>Reduce Agricultural Demand (25 to 35%)</u> | | |
| | | Following/Partial Season Agreements (up to 30%) | \$1.95 | \$4.10 |
| | | Acquire and Retire Water Rights (up to 35%) | | |
| | Range of Total Costs (annual) | | \$6.40 | \$15.00 |
| 150.d | Operate at 150 cfs | | \$0.02 | \$0.02 |
| | | <u>Reduce Carson Division Seepage (Increase Efficiency up to 75%)</u> | | |
| | | Compact the Soil Lining of Main Canals and Laterals | \$0.49 | \$1.05 |
| | | Line Main Canals and Laterals | \$8.00 | \$8.00 |
| | | <u>Supplement Carson Division Supply</u> | | |
| | | Import Dixie Valley Groundwater | \$4.40 | \$11.00 |
| | | <u>Reduce Agricultural Demand (0 to 25%)</u> | | |
| | | Following/Partial Season Agreements | \$0.00 | \$3.00 |
| | | Acquire and Retire Water Rights | \$0.00 | \$2.20 |
| | Range of Total Costs (annual) | | \$4.90 | \$22.00 |

Table 4-12. Measures Selected for Preliminary Alternatives with a 150 cfs Flow Stage (contd.)

| Preliminary Alternative Name | Measure Selected for Safety Objective | Measures Available for Water Supply Objective | Estimated Costs (\$ Million, annual) ^{1,2} | |
|------------------------------|---------------------------------------|---|---|----------------|
| | | | Low | High |
| 150.e | Operate at 150 cfs | | \$0.02 | \$0.02 |
| | | <u>Reduce Truckee Division Seepage</u> | | |
| | | Compact the Soil Lining of the Truckee Canal | \$0.19 | \$0.37 |
| | | <u>Reduce Agricultural Demand (25 to 40%)</u> | | |
| | | Fallowing/Partial Season Agreements (up to 30%) | \$1.95 | \$4.50 |
| | | Acquire and Retire Water Rights (up to 40%) | | |
| | Range of Total Costs (annual) | | \$2.20 | \$4.90 |
| 150.f | Operate at 150 cfs | | \$0.02 | \$0.02 |
| | | <u>Reduce Truckee Division Seepage</u> | | |
| | | Compact the Soil Lining of the Truckee Canal | \$0.19 | \$0.37 |
| | | <u>Reduce Carson Division Seepage (Increase Efficiency up to 75%)</u> | | |
| | | Compact the Soil Lining of Main Canals and Laterals | \$0.49 | \$1.05 |
| | | Line Main Canals and Laterals | \$8.00 | \$8.00 |
| | | <u>Reduce Agricultural Demand (15 to 30%)</u> | | |
| | | Fallowing/Partial Season Agreements | \$1.20 | \$3.60 |
| | | Acquire and Retire Water Rights | \$1.35 | \$2.70 |
| | Range of Total Costs (annual) | | \$1.90 | \$12.00 |

Notes:

Discrepancies may exist due to rounding (Reclamation Manual Directives and Standards FAC 09-01).

¹ Annual cost for each measure is discussed in Appendix E2.

² Annual costs include interest and amortization of the field cost based on the current Federal discount rate of 4 percent, over an assumed service life of the measures included (from 5 to 65 years depending on the specific measure).

Key:

cfs = cubic feet per second

HDPE = High Density Polyethylene

Preliminary Alternatives for the 0 cfs Flow Stage

Six preliminary alternatives were developed for meeting the Study objectives with a Truckee Canal flow stage of 0 cfs. The following discussion of preliminary alternatives for the 0 cfs flow stage is organized differently than in previous sections. The 0 cfs condition for the Truckee Canal creates distinctly different challenges for the Truckee and Carson divisions, and the approaches for resolving these challenges were found to be unrelated – without the Truckee Canal to connect the Project’s two divisions, each division’s source of supply is

independent. Therefore, separate approaches were developed for meeting the water supply objective in each division.

To be considered complete, all preliminary alternatives must contain an approach for meeting the water supply objective for both divisions. Four approaches were developed for the Carson Division: Carson Division 0.a, 0.b, 0.c, and 0.d. Two approaches were developed for the Truckee Division: Truckee Division 0.y and 0.z. Thus, the number of preliminary alternatives includes a total of eight combinations of the approaches for the Carson and Truckee divisions.

The estimated annual cost for meeting both Study objectives at the 0 cfs flow stage ranges from \$6.2 million to \$36 million, depending on the measures selected. Although the group of 0 cfs Truckee Canal preliminary alternatives is the most expensive group of all preliminary alternatives developed, some Project stakeholders, such as the Pyramid Lake Paiute Tribe, have a longstanding interest in exploring whether it is possible to decommission the structure while still keeping the Project viable into the future. If a 0 cfs preliminary alternative were to be studied further by the tribe or another entity, it would be important to estimate the value of water that would remain in the Truckee River instead of being diverted into the Truckee Canal. Based on recent Truckee Division water right purchases by the Pyramid Lake Paiute Tribe (\$4,000 – \$6,000 per acre-foot), the market value of non-diverted water under a 0 cfs condition is estimated to range between \$280 million and \$420 million. Using the Federal discount rate over a 50-year period, the annual benefit is estimated at between \$13.03 million and \$19.55 million. Appendix D8, “Market Value of Non-diverted Water Under a 0 cfs Truckee Canal,” describes the approach developed for arriving at this estimate.

The following sections provide additional detail on the water supply needs at a flow stage of 0 cfs, and the rationale behind selecting measures to meet Study objectives.

Approaches for Meeting the Safety Objective at 0 cfs

Decommissioning all or most of the Truckee Canal, in combination with select structural repairs and ongoing O&M, will meet the Study’s safety objective. For half of the preliminary alternatives, the entire Truckee Canal is considered fully decommissioned; the remaining preliminary alternatives decommission the Fernley and Lahontan reaches only.

As the Fernley Reach is the urbanized portion of the Truckee Canal, it represents the highest risk to public safety from operating the canal. A measure to refurbish the Derby Reach and provide surface water to the Truckee Division through the TC-1 takeout was preserved for consideration in the approaches to meeting the water supply objective for the Truckee Division. The cost of refurbishing the TC-1 takeout were taken from the Corrective Action Study’s specifications for the Derby Reach under the 250 cfs condition. Implementation

of this measure is expected to result in a cost-savings, as the repairs required to bring the Derby Reach up to Reclamation standards for 250 cfs are less expensive than having the reach decommissioned.

Approaches for Meeting the Water Supply Objective in the Carson Division at 0 cfs

Carson Division 0.a The approach for Carson Division 0.a meets the water supply objective through a reduction in Project demand of 70 percent to 80 percent. The ability to meet the water supply objective with demand reductions is described in Appendix D3. Carson Division 0.a relies upon two measures in the “Reduce Agricultural Demand” category, alone or in combination. Up to 30 percent of the demand reduction could occur through implementation of dry-year demand reduction programs, such as volunteer fallowing programs or partial forbearance agreements. The remaining 40 percent to 50 percent of agricultural demand reduction needed could occur through the acquisition and retirement of water rights in the Carson Division.

Carson Division 0.b The approach for Carson Division 0.b meets the water supply objective through increases in Project efficiency and through a reduction in Project demand of 60 percent to 70 percent.

Carson Division 0.b would include one of two measures from the “Reduce Carson Division Seepage” subcategory: lining or compacting the soil lining of the division’s main conveyance features. Both have the potential to produce increases in Project efficiency that will contribute to meeting the water supply objective (see Appendix D4). The range of estimated costs for these measures reflects unknowns in the extent of potential canal rehabilitation needed and differences in price between the two approaches. If implemented, either of these may also reduce maintenance costs to TCID.

As with Carson Division 0.a, to address remaining unmet demand, Carson Division 0.b includes two measures in the “Reduce Agricultural Demand” category, alone or in combination. Up to 30 percent of the demand reduction could occur through implementation of dry-year demand reduction programs. The remaining 30 percent to 40 percent of agricultural demand reduction needed could occur through the acquisition and retirement of water rights in the Carson Division.

Carson Division 0.c The approach for Carson Division 0.c meets the water supply objective through the importation of Dixie Valley groundwater and through a reduction in Project demand of 60 percent to 70 percent.

The assessed yield of Dixie Valley (35,000 acre-feet per year) meets a portion of the Carson Division’s water supply needs under the 0 cfs flow stage. However, meeting the water supply objective requires obtaining more than this volume for a large number of years.

As with Carson Division 0.a and Carson Division 0.b, to address remaining unmet demand, Carson Division 0.c includes two measures in the “Reduce Agricultural Demand” category, alone or in combination. Up to 30 percent of the demand reduction could occur through implementation of dry-year demand reduction programs. The remaining 30 percent to 40 percent of agricultural demand reduction needed could occur through the acquisition and retirement of water rights in the Carson Division.

Carson Division 0.d The approach for Carson Division 0.d meets the water supply objective through three measures: (1) increases in Project efficiency, (2) importation of Dixie Valley groundwater, and (3) a reduction in Project demand of 50 percent to 60 percent.

One of two measures from the “Reduce Carson Division Seepage” subcategory would be selected for Carson Division 0.d: lining or compacting the soil lining of the division’s main conveyance features. Both have the potential to produce increases in Project efficiency that will contribute to meeting the water supply objective (see Appendix D4).

The assessed yield of Dixie Valley (35,000 acre-feet per year) meets a portion of the Carson Division’s water supply needs under the 0 cfs flow stage. However, meeting the water supply objective requires obtaining more than this volume for a large number of years. To address remaining unmet demand, Carson Division 0.d includes two measures in the “Reduce Agricultural Demand” category, alone or in combination. Up to 30 percent of the demand reduction could occur through implementation of dry-year demand reduction programs. The remaining 20 percent to 30 percent of agricultural demand reduction needed could occur through the acquisition and retirement of water rights in the Carson Division.

Table 4-13 includes the estimated annual costs for the Carson Division-specific components of the 0 cfs flow stage preliminary alternatives.

Table 4-13. Components of Preliminary Alternatives with a 0 cfs Flow Stage for the Carson Division

| Component of 0 cfs Preliminary Alternative | Measure Selected for Safety Objective | Measures Available for Water Supply Objective | Estimated Costs (\$ Million, annual) ^{1,2} | |
|--|---------------------------------------|---|---|----------------|
| | | | Low | High |
| Carson Division 0.a | Decommission the Truckee Canal | | <i>See Truckee Component</i> | |
| | | <u>Reduce Agricultural Demand (70 to 80%)</u> | | |
| | | Following/Partial Season Agreements (up to 30%) | \$5.60 | \$10.00 |
| | | Acquire and Retire Water Rights (up to 80%) | | |
| | Range of Total Costs (annual) | | \$5.60 | \$10.00 |
| Carson Division 0.b | Decommission the Truckee Canal | | <i>See Truckee Component</i> | |
| | | <u>Reduce Carson Division Seepage (Increase Efficiency up to 75%)</u> | | |
| | | Compact the Soil Lining of Main Canals and Laterals | \$0.49 | \$1.05 |
| | | Line Main Canals and Laterals | \$8.00 | \$8.00 |
| | | <u>Reduce Agricultural Demand (60 to 70%)</u> | | |
| | | Following/Partial Season Agreements (up to 30%) | \$4.70 | \$6.80 |
| | | Acquire and Retire Water Rights (up to 70%) | | |
| | Range of Total Costs (annual) | | \$5.20 | \$15.00 |
| Carson Division 0.c | Decommission the Truckee Canal | | <i>See Truckee Component</i> | |
| | | <u>Supplement Carson Division Supply</u> | | |
| | | Import Dixie Valley Groundwater | \$4.40 | \$11.00 |
| | | <u>Reduce Agricultural Demand (60 to 70%)</u> | | |
| | | Following/Partial Season Agreements (up to 30%) | \$4.70 | \$6.80 |
| | | Acquire and Retire Water Rights (up to 70%) | | |
| | Range of Total Costs (annual) | | \$9.10 | \$18.00 |

Table 4-13. Components of Preliminary Alternatives with a 0 cfs Flow Stage for the Carson Division (contd.)

| Component of 0 cfs Preliminary Alternative | Measure Selected for Safety Objective | Measures Available for Water Supply Objective | Estimated Costs (\$ Million, annual) ^{1,2} | |
|--|---------------------------------------|---|---|---------|
| | | | Low | High |
| Carson Division 0.d | Decommission the Truckee Canal | | See Truckee Component | |
| | | <u>Reduce Carson Division Seepage (Increase Efficiency up to 75%)</u> | | |
| | | Compact the Soil Lining of Main Canals and Laterals | \$0.49 | \$1.05 |
| | | Line Main Canals and Laterals | \$8.00 | \$8.00 |
| | | <u>Supplement Carson Division Supply</u> | | |
| | | Import Dixie Valley Groundwater | \$4.40 | \$11.00 |
| | | <u>Reduce Agricultural Demand (50 to 60%)</u> | | |
| | | Fallowing/Partial Season Agreements (up to 30%) | \$3.90 | \$5.90 |
| | | Acquire and Retire Water Rights (up to 60%) | | |
| | Range of Total Costs (annual) | | \$8.80 | \$25.00 |

Notes:

Discrepancies may exist due to rounding (Reclamation Manual Directives and Standards FAC 09-01).

¹ Annual cost for each measure is discussed in Appendix E2.

² Annual costs include interest and amortization of the field cost based on the current Federal discount rate of 4 percent, over an assumed service life of the measures included (from 5 to 65 years depending on the specific measure).

Key:

cfs = cubic feet per second

HDPE = High Density Polyethylene

Approaches for Meeting the Water Supply Objective in the Truckee Division at 0 cfs

The Truckee Division relies entirely upon the Truckee Canal for its water supplies, and thus the decommissioning of the Truckee Canal poses a singular challenge for its water rights holders: a complete replacement of the supply, the conveyance for importing supplies, or both.

This Study did not identify alternative sources capable of completely removing the Truckee Division's dependence on Truckee River water rights. An additional source for agricultural use could be developed through the treatment and reuse of City of Fernley wastewater. However, this does not fully meet agricultural demand in the division. Therefore, the measures available to the Truckee Division rely significantly on developing alternative conveyance mechanisms for existing water rights on the Truckee River.

Truckee Division 0.y The approach for Truckee Division 0.y meets the water supply objective through one measure retires agricultural demand in the Truckee Division.

From the “Reduce Agricultural Demand” category, Truckee Division 0.y relies upon the acquisition and retirement of 100 percent of all rights in the Truckee Division that are not held by the City of Fernley for M&I use.

Truckee Division 0.z The approach for Truckee Division 0.z meets the water supply objective through measures to develop a conveyance to supply agricultural water rights holders with reliable supplies, and the potential replacement of some portion of Truckee Canal supplies.

Truckee Division 0.z relies on the development of a conveyance structure for supplying water to the agricultural water rights holders along the Truckee Canal. A single measure was identified for this: construction of a pressurized steel pipeline along the existing right-of-way corridor for the Truckee Canal, with stems for delivering water at each of the current canal take-out locations.

Truckee Division 0.z would include at least one of two sources for replacing the Truckee Canal supply to serve Truckee Division agricultural water rights. Sufficient capacity would exist at either of the available supplemental points of delivery described above to provide Truckee River water to the agricultural users. However, a second option exists to supply the agricultural users with reclaimed wastewater from the City of Fernley. This option requires less water to be diverted from the Truckee River, which could result in cost savings for the sizing of diversion or delivery facilities.

The City of Fernley currently treats its wastewater to a secondary level, which would be appropriate for application to alfalfa, but not livestock. Conveyance of secondary treated water would require a more chemically resilient conveyance, at a higher cost, but would require no additional cost for the treatment of existing wastewater. Alternately, the City of Fernley wastewater could be treated to an advanced standard that would be acceptable for application to crops and livestock. This would require additional treatment and upgrade of the current wastewater facilities; however, a less expensive material would be allowed for the pipeline conveyance.

Table 4-14 includes the estimated annual costs for the Truckee Division-specific components of the 0 cfs flow-stage alternatives.

Table 4-14. Truckee Division Components for Preliminary Alternatives with a 0 cfs Flow Stage

| Component of 0 cfs Preliminary Alternative | Measure Selected for Safety Objective | Measures Available for Water Supply Objective | Estimated Costs (\$ Million, annual) ^{1,2} | |
|--|---------------------------------------|--|---|----------------|
| | | | Low | High |
| Truckee Division 0.y | Decommission the Truckee Canal | | \$0.52 | \$0.52 |
| | | <u>Reduce Agricultural Demand (100% for Truckee Division Agriculture)</u> | | |
| | | Acquire and Retire Water Rights | \$0.48 | \$0.48 |
| | Range of Total Costs (annual) | | \$1.00 | \$1.00 |
| | | | Low | High |
| Truckee Division 0.z | Decommission the Truckee Canal | | \$0.52 | \$0.52 |
| | | <u>Establish New Truckee Division Points of Diversion and Delivery (Agriculture)</u> | | |
| | | Construct Pipeline to Agricultural Users | \$7.90 | \$8.60 |
| | | <u>Supplement Truckee Division Supply (for Truckee Division Agriculture)</u> | | |
| | | Use City of Fernley Point of Diversion | \$0.00 | \$0.00 |
| | | Treat Effluent and Deliver for Agricultural Use | \$0.00 | \$1.85 |
| | Range of Total Costs (annual) | | \$8.40 | \$11.00 |

Notes:

Discrepancies may exist due to rounding (Reclamation Manual Directives and Standards FAC 09-01).

¹ Annual cost for each measure is discussed in Appendix E2.

² Annual costs include interest and amortization of the field cost based on the current Federal discount rate of 4 percent, over an assumed service life of the measures included (from 5 to 65 years depending on the specific measure).

Key:

cfs = cubic feet per second

HDPE = High Density Polyethylene

Selection of Study Alternatives

Figure 4-10 describes attributes of the preliminary alternatives developed for the Study: estimated range of annualized costs, complexity (defined by number of measures required to meet both objectives), the extent of temporary or permanent demand reduction required (a concern of all water rights holders in the Project), the annual hydropower production by the Project (a key component of financial revenues for TCID), the annual seepage losses from Truckee Canal (a concern of the City of Fernley, Truckee Division water users, and the Pyramid Lake Paiute Tribe), and the average annual flow to Pyramid Lake (a concern of the Pyramid Lake Paiute Tribe). The values in this figure are not precise, and reflect estimated outcomes for each preliminary alternative. These parameters represent the readily quantifiable attributes of each preliminary alternative, as developed during the measures screening and overall planning process.

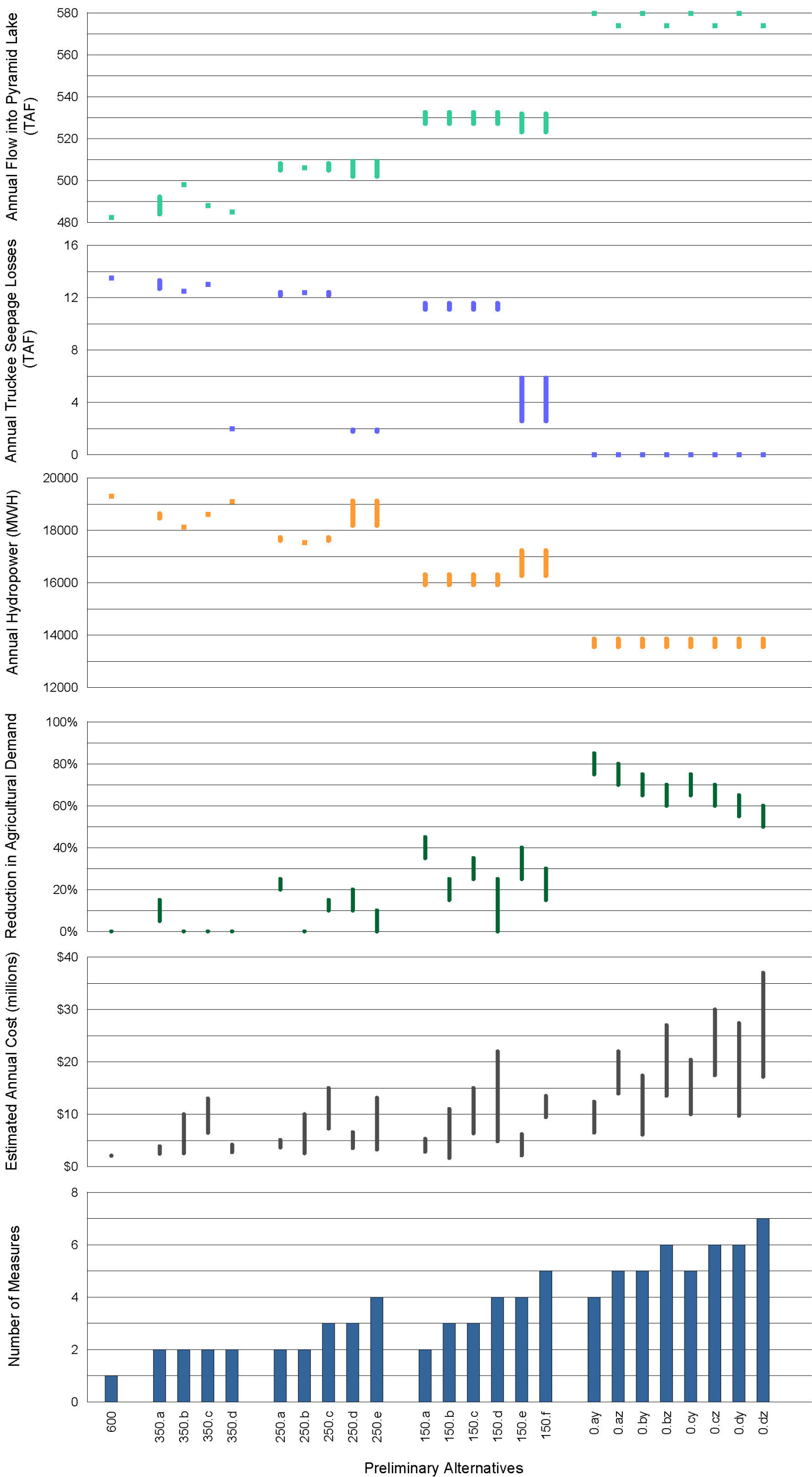


Figure 4-10. Key Attributes of Preliminary Alternatives

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Agency Review of Preliminary Alternatives and Planning Criteria

Once preliminary alternatives were developed, the Study team sought the review of agencies and tribes, which presented opportunities for agencies to:

- Understand how measures identified for consideration in the Study have been characterized and analyzed, and suggest revisions to the characterizations of particular measures used in preliminary alternatives.
- Contribute to the descriptions of the preliminary alternatives and identify the potential for benefits or negative impacts associated with each.
- Identify or clarify how planning criteria could be used in selecting and refining Study alternatives.
- Provide feedback on priorities for remaining analyses in the Study.

The Study team reviewed the preliminary alternatives and draft Special Report with representatives from TCID, the City of Fernley, Churchill County, the Pyramid Lake Paiute Tribe, and USFWS. The comments received assisted the Study team in applying the planning criteria to select alternatives for further evaluation. Comments received during this review appear in Appendix H, “Public Participation and Outreach Report.”

Inclusion of agencies in the review and assessment of the preliminary alternatives also promotes the Study’s intent, which is the development of plans for meeting Study objectives that, ultimately, may be implemented by local, regional, State, and/or Federal partners.

Application of Planning Criteria

Following the agency review of preliminary alternatives and planning criteria, the planning criteria could be further applied to screen the preliminary alternatives. The purpose of this screening of preliminary alternatives is to reduce the number of options available for consideration before proceeding with more detailed evaluation of alternatives. This step further leverages the criteria that have been used in the identification of preliminary alternatives that are the most suitable for a more rigorous analysis. The following section discusses how the preliminary alternatives were viewed under each of the P&G criteria. The discussion in this section relies heavily upon comparisons between alternatives made with information shown in Figure 4-10.

Completeness

Completeness is a determination of whether an alternative includes all of the elements necessary to realize its planned effects, and to the degree that the intended benefits depend on other actions.

With respect to completeness, all preliminary alternatives contain the basic actions necessary to achieve their intent to meet the Study objectives. However, uncertainty exists surrounding certain measures or features of some alternatives in particular. These are noted in the subsections below.

150 cfs Flow Stage

The 150 cfs preliminary alternatives may not be complete for a variety of reasons, including:

- Safety is not necessarily assured, and would require further Reclamation review to approve of continued operation.

Fernley has unpublished results indicating that Truckee Canal seepage may be insufficient for meeting local groundwater availability needs, and further measures may be required to meet these needs at a 150 cfs flow stage (City of Fernley 2012). All 150 cfs preliminary alternatives rely upon the reduced flow-stage to satisfy the safety objective.

Compaction

Compaction may not work effectively to reduce seepage from the Project's canals and laterals. Comments from TCID during the agency's review of preliminary alternatives suggest that the technique, which has delivered highly desirable results in California, may not work in Nevada for a variety of reasons (Walter Winder, TCID, personal communication, October 4, 2012). This includes different conditions than are present in Nevada, different soil geology, and the freeze-thaw cycles which could "un-compact" canal soils each winter. This would require that all 300-plus miles of canals and laterals be re-compacted annually immediately after the thaw, which may not be practical and would increase costs. Preliminary alternatives that rely upon compaction include 150.e and 150.f. Up to nine other preliminary alternatives also have the option to include compaction of canals and laterals to reduce losses due to seepage, but do not need to rely on this method.

Availability of Willing Participants for Demand Reduction Programs

In reviewing the preliminary alternatives with agencies and tribes, several raised concerns that the high level of temporary or permanent agricultural land retirement anticipated for some of the preliminary alternatives, particularly those for 150 cfs and 0 cfs, may not be realistic:

- Willing sellers are not plentiful: there has been a decreasing level of interest in participating in existing water rights purchasing programs, such as USFWS's acquisition program for Lahontan Valley wetlands.
- The new dry milk processing facility planned for construction in Fallon is expected to encourage the preservation of agricultural land uses in the Project and could increase the value of those rights (Churchill County 2012; TCID 2012b).

Existing or completed programs aimed at acquiring Project water rights have succeeded in purchasing about 25 percent of the Project's agricultural water rights. Additionally, this report has previously noted that temporary agricultural demand reduction programs are likely limited to a participation level of no more than approximately 30 percent. By limiting the extent of demand reduction to a maximum of 30 percent of agricultural water rights, it may be possible to consider applying a blend of temporary and permanent programs for some alternatives.

The preliminary alternatives that meet the water supply objective by relying on measures to reduce Project demand by 30 percent or more include 150.a, 150.c, 150.e, and 150.f, and all of the 0 cfs preliminary alternatives.

Use of Treated Effluent

The City of Fernley has noted that some alternatives may not be complete because they rely on the use of the city's treated effluent to serve Truckee Division agricultural needs, which would require a separate agreement that the city has not granted (City of Fernley 2012). Four preliminary alternatives contain this measure: 0.ay, 0.by, 0.cy, and 0.dy.

Effectiveness

Effectiveness is the extent to which an alternative alleviates identified problems.

All preliminary alternatives for the flow stages achieve a minimum level of effectiveness because they have been designed to meet both the safety and water supply objectives of the Study. Some are likely to be more effective than the Study requires. For instance, the 600 cfs preliminary alternative provides a higher level of water supply reliability than the Desired Reliability level.

Additionally, there appears to be an inherent, underlying contradiction in achieving the water supply objective by reducing the Project's overall demand for water. If part of meeting this objective is allowing Project users to exercise their water rights, it is likely that preliminary alternatives which do not rely on a high amount of water rights retirement achieve the goals of the Study more effectively. Although there is no firm line that can be drawn over which any additional land retirement attempts undermine the Study objective to serve water rights holders, this Study assumes preliminary alternatives containing less than 50 percent demand reduction are more effective than others. The 150.a preliminary alternative and all 0 cfs preliminary alternatives require reducing agricultural demand for Project water by at least 50 percent.

Efficiency

Efficiency is the extent to which an alternative is the most cost-effective and/or least complex means of alleviating the identified problems.

The preliminary alternatives differ significantly in their overall efficiency – the relative simplicity and cost effectiveness with which they meet the Study

objectives. The least efficient preliminary alternatives include many of those developed for 150 cfs flow stage and the 0 cfs flow stage. This is because, in a broad sense, they tend to include some of the most complicated or most expensive actions needed to achieve at a minimum the same outcome as other less expensive and less complicated preliminary alternatives. For example, preliminary alternative 0.dz includes seven distinct measures; the low-end estimate for 0.dz's potential cost also exceeds the high-end cost for at least 17 of the other preliminary alternatives.

Additionally, preliminary alternatives that contain use of imported groundwater from Dixie Valley are, on average, much more expensive than other preliminary alternatives that rely on different measures to meet the water supply objective at the same flow stage.

To provide a contrast to these, the 600 cfs flow-stage preliminary alternative is likely the most efficient of any preliminary alternative because the safety objective is achieved with the lowest-cost fix for an active canal and the water supply objective is met by the flow stage itself. It includes the fewest and cheapest measures of any preliminary alternative.

The following preliminary alternatives achieve the Study objectives using more than three measures and/or do so at an annual cost of at least \$15 million: 250.e, 150.d, 150.e, 150.f, and all of the 0 cfs preliminary alternatives. The preliminary alternatives that include the use of Dixie Valley are 350.c, 250.c, 150.c, 0.cy, and 0.cz.

Acceptability

Acceptability is the workability and viability of an alternative with respect to its potential acceptance by other Federal agencies, state and local government agencies, and public groups and individuals, as well as its compatibility with existing laws, regulations, and policies.

All alternatives are possible to implement under existing laws, regulations, and policies, although the implementation hurdles may differ. Acceptability of preliminary alternatives to various Federal, state, or local agencies and other groups varies consistent with those entities' diverse sets of interests and concerns – no preliminary alternative is highly acceptable or highly unacceptable to all groups. Considering acceptability of the preliminary alternatives by flow-stage category:

- For the 600 cfs preliminary alternative, acceptability is generally high, with one group (Pyramid Lake Paiute Tribe) likely to find it less acceptable, as this preliminary alternative would result in the most flows being diverted from the Truckee River and would also continue efficiency losses in the Fernley Reach of the Truckee Canal.

- The 350 cfs preliminary alternatives likely offer a medium level of acceptability for all entities, although acceptability may vary depending on the specific measures contained in each. While Project water users or other groups are unlikely to consider a 350 cfs flow stage the most attractive option, few will find it the most objectionable flow stage considered by the Study. This flow stage may perform at a slightly lower level of reliability than the 600 cfs flow stage, but the difference noticed by Project users is likely to be quite small.
- The 250 cfs preliminary alternatives offer, in general, low-to-medium levels of acceptability, for similar reasons as the 350 cfs preliminary alternatives.
- The 150 cfs preliminary alternatives are likely to carry low levels of acceptability for Project water users, but a higher level of acceptability for one group (Pyramid Lake Paiute Tribe). Review of the 150 cfs preliminary alternatives by agencies also yielded objections to 150 cfs from TCID due to potential injury to existing water rights and from the City of Fernley due to groundwater concerns (TCID 2012b; City of Fernley 2012).
- The 0 cfs preliminary alternatives also offer a generally low level of acceptability, with the exception of one group (Pyramid Lake Paiute Tribe), who is likely to find these alternatives highly acceptable due to the potential for large increases of flow to Pyramid Lake as a result of decommissioning the Truckee Canal. Many Project water users do not consider a 0 cfs flow stage an acceptable approach to meeting Study objectives (City of Fernley 2012, TCID 2012b).

Refinement of Alternatives that Rely on Demand Reduction

Alternatives 350.a, 250.a, and 250.d were originally formulated as preliminary alternatives which included some amount of reduction in Project demand to meet the Study's water supply objective. However, both the method of demand reduction (permanent retirement or dry-year fallowing of water-righted agricultural land) and the actual extent of demand reduction needed for each alternative was not identified.

As a result, once alternatives 350.a, 250.a, and 250.d were selected, the Study conducted an analysis to assist in determining which measure should be selected and the extent of its application (see Appendix F, "Performance of Selected Alternatives on Newlands Project Water Supply Reliability").

For Alternative 350.a, this analysis revealed that, given the historical cultural practice of irrigators to use a reduced (95 percent) portion of their maximum water rights volume, Alternative 350.a did not require additional demand reduction to achieve the water supply objective (see Chapter 3 and Appendix C for a discussion of this assumption).

The first set of analysis for both Alternative 250.a and Alternative 250.d assessed the effects of permanent water-righted land retirement on the water supply reliability for each alternative. The analysis scaled up the extent of retirement in 5-percent increments until the alternatives met or exceeded the Desired Reliability. For Alternative 250.a, 0 percent through 15 percent retirement were considered. For Alternative 250.d, 0 percent through 5 percent retirement were considered.

The second set of analysis for both Alternative 250.a and Alternative 250.d assessed the effects of dry-year fallowing on the water supply reliability for each alternative. This analysis also scaled up the extent of dry-year fallowing in 5-percent increments until the alternatives met or exceeded the Desired Reliability. Because dry-year fallowing programs are relatively less effective per acre than permanent retirement, a greater extent of temporary fallowing was assumed to be required to achieve equivalent levels of performance as permanent retirement. For Alternative 250.a, 20 percent through 25 percent fallowing during dry years were considered. For Alternative 250.d, 5 percent through 10 percent during dry years were considered.

Table 4-15. Type and Extent of Demand Reduction Identified for Alternatives 250.a and 250.d

| | Permanent Retirement | Dry-Year Fallowing |
|--------------------------|-----------------------------|---------------------------|
| Alternative 250.a | 15% | 25% |
| Alternative 250.d | 5% | 10% |

To select between the permanent retirement and dry-year fallowing options, the Study team again considered how each may perform against the Federal planning criteria:

- **Completeness:** As noted previously, permanent retirement options may render some alternatives less complete due to concerns about the availability of willing sellers.
- **Effectiveness:** Permanent retirement and dry-year fallowing options are equivalent in their effectiveness at meeting the Study's water supply objective under alternatives 250.a and 250.d.
- **Efficiency:** Per-acre costs are lower for dry-year fallowing, but this approach generally requires about twice as much demand reduction as permanent retirement to meet the equivalent reliability goals. Ultimately, costs are higher for dry-year programs, making them less efficient.

- **Acceptability:** There is a potential for strong resistance to additional attempts to purchase water-righted agricultural land in the Truckee and Carson river basins, as acreage has already been reduced by water-rights purchase programs and large quantities of Project rights have been transferred to environmental uses. As dry-year fallowing is a temporary reduction in demand that does not diminish the overall size of the Project, this approach may be more acceptable to water rights holders, stakeholders, and others.

The above considerations led the Study team to select the dry-year fallowing options for Alternative 250.a (25 percent) and Alternative 250.d (10 percent).

Summary of Alternative Selection

Application of the planning criteria revealed that preliminary alternatives that rely upon canal decommissioning (0 cfs), a 150 cfs flow stage, Dixie Valley imports, or high levels of temporary or permanent water rights retirement appear to be outliers against criteria for completeness and efficiency.

Preliminary alternatives that would retire at least half of the Project's water rights are also judged to be outliers for the effectiveness criterion. Application of the acceptability criterion did not eliminate any alternatives, but helped identify the levels of acceptability different entities may associate with the range of flow stages considered.

As a result, seven preliminary alternatives out of the initial list of 24 have been selected for further evaluation in the Study (Table 4-16).

Table 4-16. Summary of Preliminary Alternatives Performance Against Planning Criteria

| Alt. | Completeness | Effectiveness | Efficiency | Acceptability | Retained for further consideration |
|--------------|---------------|----------------|----------------|----------------------------------|------------------------------------|
| 600 | High | High | High | Varies by Stakeholder and Agency | Yes |
| 350.a | High | High-to-Medium | High-to-Medium | Medium | Yes |
| 350.b | High | High-to-Medium | High-to-Medium | | Yes |
| 350.c | High | High-to-Medium | Low | | |
| 350.d | High | High-to-Medium | High-to-Medium | | Yes |
| 250.a | High | High-to-Medium | High-to-Medium | Medium-to-Low | Yes |
| 250.b | High | High-to-Medium | High-to-Medium | | Yes |
| 250.c | High | High-to-Medium | Low | | |
| 250.d | High | High-to-Medium | High-to-Medium | | Yes |
| 250.e | High | High-to-Medium | Low | | |
| 150.a | Low | Low | High-to-Medium | Varies by Stakeholder and Agency | |
| 150.b | Low | High-to-Medium | High-to-Medium | | |
| 150.c | Low | High-to-Medium | Low | | |
| 150.d | Low | High-to-Medium | Low | | |
| 150.e | Low | High-to-Medium | Low | | |
| 150.f | Low | High-to-Medium | Low | | |
| 0.ay | Low | Low | Low | Varies by Stakeholder and Agency | |
| 0.az | Medium-to-Low | Low | Low | | |
| 0.by | Low | Low | Low | | |
| 0.bz | Medium-to-Low | Low | Low | | |
| 0.cy | Low | Low | Low | | |
| 0.cz | Medium-to-Low | Low | Low | | |
| 0.dy | Low | Low | Low | | |
| 0.dz | Medium-to-Low | Low | Low | | |

Key:

Alt. = Alternative Name

Scale



Lower
Performance

Higher
Performance

Chapter 5 Alternatives

This chapter provides an overview of the features and potential effects of the Without-Action Alternative and each of the action alternative plans selected for the Study (Study Alternatives). Of the 24 preliminary action alternative plans formulated in Chapter 4, the following seven were selected for further analysis and comparison as Study alternatives:

- Alternative 600 (600 cfs Truckee Canal)
- Alternative 350.a (350 cfs Truckee Canal)
- Alternative 350.b (350 cfs Truckee Canal plus lining a portion of the Carson Division's canals and laterals)
- Alternative 350.d (350 cfs Truckee Canal plus lining portions of the Truckee Canal)
- Alternative 250.a (250 cfs Truckee Canal plus land retirement)
- Alternative 250.b (250 cfs Truckee Canal plus lining a portion of the Carson Division's canals and laterals)
- Alternative 250.d (250 cfs Truckee Canal plus lining portions of the Truckee Canal and land retirement)

Each of the Study alternatives includes safety and water supply measures.

- **Safety Measures** – All alternatives include a set of actions to reduce risk to public safety from operating the Truckee Canal. These are identified in the Corrective Action Study and Risk Assessments (Reclamation 2011a-d), and summarized in Chapter 4, “Measures and Preliminary Alternatives.” Each alternative includes the full set of measures required to meet the safety objective.
- **Water Supply Measures** – In addition to the actions to meet the safety objective, most alternatives also include actions to serve Project water rights holders with a certain level of reliability (Desired Reliability) into the future. These measures are derived from previous studies and reports, public and agency input, and Study team judgment, and are summarized in Chapter 4, “Measures and Preliminary Alternatives.”

Each alternative includes the full set of measures included to meet the water supply objective.

This chapter describes the major components, accomplishments, and primary effects of each Study alternative. The accomplishments and effects of the Study alternatives are determined in comparison to the Without-Action Alternative, but may also be compared to the Desired Reliability condition where useful.

This chapter is organized in the following manner:

- **Evaluation Methods** – this section describes the methods used to characterize and assess the Without-Action and Study alternatives.
- **Alternative Descriptions** – in separate sections for each alternative, descriptions are provided for the major components and primary effects of the Without-Action and the seven Study alternatives.

Evaluation Methods

This section describes evaluation methods used to assess the features and effects of alternatives. Evaluation methods are described for plan formulation, engineering and cost estimates, water supply operations modeling, hydropower generation modeling, environmental and regulatory review, and economics and benefits assessments.

Plan Formulation

This Study used an iterative planning process to identify and evaluate more than 50 individual measures for their performance in contributing to the safety and water supply objectives. The measures were considered in a screening process that carried through three phases as documented in Chapter 4. The Study team combined the remaining measures to form twenty-four preliminary alternatives, to which the Study team then applied the Federal water resources planning criteria to select the seven alternatives described in this chapter.

Each Study alternative was assessed for its ability to meet the Desired Reliability in chapters 2 through 4. An alternative was considered sufficient in meeting the Desired Reliability when: (1) the largest deficit in delivery relative to the Desired Reliability condition was less than or equal to 10,000 acre-feet, and (2) the average of differences in delivery between the alternatives and the Desired Reliability was greater than zero. An in-depth discussion of the water supply performance of each alternative can be found in Appendix F.

Engineering and Cost Estimates

For each alternative, the Study has identified estimates for a variety of associated costs. All cost estimates presented are appraisal-level and at a January 2012 price level. Appraisal level cost estimates are developed for

planning purposes, can be used for comparison of alternatives, and are not suitable for requesting project authorization or construction fund appropriations.

- **Field Costs** – Field costs represent an estimate of capital costs of a feature or project from award to construction closeout. Allowances for mobilization, design contingencies, allowance for procurement strategies (APS), and construction contingencies are included in field costs. Field costs for the alternatives are based on the costs developed for the measures that comprise the alternatives. Development of these costs is discussed in Appendix E2, “Initial Cost Estimates for Screening of Measures.”
- **Non-contract Costs** – To determine the total construction cost for each alternative, non-contract costs were developed and added to the field costs. Non-contract costs refer to (1) costs of work or service provided in support of the implementation of a project, and (2) other work that can be attributed to the project as a whole, known as distributed costs. Non-contract costs were divided into five categories for this Study and are as follows:
 - **Planning and Environmental Compliance** – This includes collection, assembly, analysis of data, and preparation and review of additional planning studies, environmental impact reports, and environmental mitigation. This may also include preparation of feasibility design and cost estimates, surveying and design specifications, environmental oversight, and legal services.
 - **Engineering and Design** – This includes preparation and review of final designs, construction drawings, specifications, and construction cost estimates.
 - **Construction Management** – This includes engineering administration, management, coordination, and control of construction activities.
 - **Easements** – This includes any temporary construction easement requirements.
 - **Cultural Resources** – This includes coordination with Nevada SHPO, compliance documentation, and mitigation.

These non-contract costs were based on specific percentages of the field costs, and are described further in Appendix E3, “Appraisal Cost Estimates for Alternatives.”

- **Capital Costs** – Capital cost represents the total cost of planning and constructing a project. It includes the field costs, non-contract costs, and interest during construction (IDC).
- **Annual Costs** – Total annual costs for each alternative were estimated by interest and amortization of the capital cost over 50 years and at the current Federal discount rate. Annual O&M costs were also estimated.

Allowances for escalation from published price levels through the construction contract were not included in these estimates because of the undefined schedule for alternative implementation. Escalation would need to be determined before authorization of Federal funding. In addition, development of feasibility level non-contract costs will likely require moving from percentage based allowances to detailed line items. All cost estimates, especially at this stage in the planning process, have inherent risks and uncertainties.

The methods and assumptions for developing these costs are further described in Appendix E2, “Initial Cost Estimates for Screening of Measures” and Appendix E3, “Appraisal Cost Estimates for Alternatives.”

Water Supply and Operations Modeling

The Study relies upon the Pre-TROA Planning Model (Planning Model) to assess the effects of Study alternatives on the management of water supply and hydropower facilities within the Truckee and Carson river basins. The Planning Model is a daily-time step water management simulation model built in the RiverWare modeling environment. Simulations are performed over a 100-year period of simulation, based upon hydrology data for the 1901 – 2000 period of record. In 2012, hydrology data was updated to include an improved characterization of hydrologic variability on Truckee River tributaries, and the Planning Model has been updated to include this improved hydrology. The Planning Model considers operations of all major dams and reservoirs in Truckee and Carson basins, including Lake Tahoe, Donner, Independence, Boca, Prosser, Stampede, Derby, and Lahontan. Current flow and regulatory standards throughout the basins are included as constraints in the model, including OCAP. TROA is not represented in the Planning Model.

The Planning Model representation of the Project was revised for use in the Study. Separate representation was provided for demands among groups of Carson Division water users (M&I, agriculture, wetlands, and tribal uses). Demands for each user group were based upon the Study assessment of maximum, potentially active water rights which takes into account the completion of various water transfer, retirement program, and trends toward selling/dedicating rights (e.g., USFWS acquisition goals, AB380 retirement goals, and Truckee Division sales/dedications) and anticipates a demand for the full duty of all remaining Project water rights. A conceptual diversion was included at Derby Dam to account for the anticipated, full diversion of Project water rights by the City of Fernley.

Planning Model simulations demonstrate how changes in demand, infrastructure, or regulatory conditions could, in general, change conditions throughout the complex and interconnected Truckee and Carson river basins. The existing Planning Model operating rules were developed and refined to simulate the existing system. Inherently, computer models represent a simplified version of water resource systems and decisions made by water users, and may not fully capture the full range of possible decisions. Many unknowns exist concerning how water users will meet their institutional and regulatory commitments under some conditions simulated by the Study. Therefore, it is advisable that Planning Model results be used to provide general trends for comparing alternatives, instead of as predictions of absolute outcomes.

Results from the Planning Model are used as input to several other technical studies, including hydropower generation and economic assessments.

Several appendices to the Study provide further explanation of: the selection of the Planning Model (Appendix B1, “Operations Model Selection and Formulation”), the adaptation of Planning Model Hydrology (Appendix B2, “Revised 100-Year Hydrology”), and the assessment of potentially active water rights for various water user groups in the Truckee and Carson divisions (Appendix C, “Projected Future Water Rights and Demands for the Newlands Project”).

Hydropower Generation Modeling

Preliminary energy estimates for generation within the Newland Project at Lahontan Reservoir and 26-Foot Drop were made using a spreadsheet approach that used output from the water operations models developed for the Study. A simplified representation of hydropower facilities was created to capture relative changes in generation at Lahontan Reservoir and at the 26-Foot Drop facility on the V Canal. Key features of the hydropower generation analyses include the following:

- Monthly time-step calculations based on head and flow
- Generation unit capacity consistent with engineering assumptions
- Assumed peak and off-peak energy prices, as described in Appendix G1
- Calculated peak and off-peak power use, generation, and values

Further explanation of the methods developed to assess hydropower generation at the Lahontan and 26-Foot Drop powerplants are provided in Appendix B3, “Newlands Project Hydropower Generation.”

Accomplishments

The accomplishments noted for each alternative include how well it achieves the Study objectives (safety and water supply), and how it performs on key metrics of interest to Project water rights holders and stakeholders. The evaluation of accomplishments for each alternative is informed by the physical features of the alternative and the modeling and engineering analyses performed for the Study.

Safety

All alternatives formulated and selected by the Study to bring the urbanized portions of the Truckee Canal to meet the RR3 standard of safety, which is required for achieving the Study's safety objective; the Without-Action Alternative may somewhat meet the safety objective, although the degree to which is unknown.

Water Supply

For the purposes of this Study, alternatives are assessed against a desired level of reliability for the Newlands Project. The Desired Reliability is based upon simulations of water supply deliveries to the Newlands Project under a blend of historic and current conditions that include: the historic 900 cfs Truckee Canal capacity, historic hydrology for the Truckee and Carson basins from 1901 to 2000, current OCAP and other regulatory conditions in the Truckee and Carson river basins, and the Study's assessment of the current potentially active Project water rights. Under these conditions, the Desired Reliability results in 14 years with water supply deliveries below 95 percent of the total Project demand, average annual deliveries are 94.6 percent, and the lowest annual Project delivery is 40 percent of total demand (see chapters 2 and 3).

All Study alternatives meet or exceed the Desired Reliability; however, some may achieve higher levels of water supply deliveries than others. Desired Reliability described in Chapter 2, "Plan Formulation Process." Current demand is described in Appendix C.

Project Efficiency

Efficiency for the Newlands Project is defined as the amount of water released from Lahontan Reservoir for delivery into the Carson Division and the amount of water diverted into the Truckee Division laterals, relative to the actual headgate deliveries. This is consistent with the 1997 OCAP, previous OCAPs, and the 1994 Efficiency Study. For the Study, project water supply efficiencies are assumed to be 65 percent. Some alternatives increase the overall Project efficiency with the intent of creating additional water supply for Project water rights holders, as opposed to contributing to recoupment. Other alternatives may have the effect of increasing efficiency of P features, such as the Truckee Canal, that are not included in the traditional Project efficiency calculation. This section of the alternative descriptions notes any anticipated increases in Project efficiency that would result from implementation.

Water Quantity and Quality on Lower Truckee River

In recent decades, through the negotiation of TROA and several settlement agreements, a number of actions have been taken to improve the water quantity, and thereby the water quality, in the lower Truckee River. The Pyramid Lake Paiute Tribe continues to seek additional opportunities to increase the quality and quantity of flows on the lower Truckee River. Some alternatives may increase the quantity, and thus the overall quality, of water in the Truckee River below Derby Dam that flows into Pyramid Lake. For each alternative, the description indicates the amount of water that will not be diverted at Derby Dam relative to the Desired Reliability condition and to the without-action condition.

Hydropower Generation

Hydropower generation accounts for a significant portion of TCID's annual revenue. Some alternatives reduce TCID's ability to generate hydropower because they reduce the flow and/or head elevations for the two power plants below Lahontan Reservoir, or because they reduce flow through the power plant at 26-Foot Drop powerplant on the V Canal. Each alternative's description approximates the alternative's effect on energy production for the facilities at these two locations.

Environmental and Regulatory Considerations Review

Identification of possible environmental outcomes for each alternative is based on a review of existing data, studies, and reports, including: NEPA documents for previous actions occurring in the project area; a high-level review of environmental conditions; public, stakeholder, and agency comments; and Study team judgment. Where possible, sources for this information are noted. The evaluation of environmental outcomes is preliminary and qualitative and is intended to identify potential issues that may arise if particular alternatives are implemented. Potential environmental outcomes would require more detailed evaluation at a later time and would presumably be addressed during the NEPA process.

Each alternative has been given a preliminary level of review and analysis to identify incidental outcomes that may reduce or elevate the alternative's implementation potential or attractiveness. This could include changes in species habitat or populations, cultural or historical resources, groundwater availability, air quality, or noise.

A preliminary summary of potential regulatory and permitting requirements was compiled based on a review of previous documents, including NEPA documents for previous actions occurring in the study areas, and based on the knowledge of Reclamation staff. A more complete determination of regulatory requirements would be identified later in the process following informal consultation with regulatory agencies.

Some alternatives have significantly different regulatory hurdles associated with them. The regulatory review section identifies the known or anticipated regulatory compliance and permitting requirements for the alternatives. Although a full assessment of regulatory requirements cannot be determined until alternatives are further developed and agencies consulted, a preliminary summary of potential regulatory coordination or permitting is provided in Table 5-1. Additional detail is provided in the “Regulatory Review” section under individual alternatives. Permitting and/or formal consultation may not be required for all of the regulations listed in the table; however, it is assumed that, at a minimum, informal consultation would occur with all agencies listed.

The Newlands Project has been exempt from certain provisions of the CWA (pursuant to 40 CFR § 122.3 and NAC 445A.228), and previous work on project canals has not always required Section 401 or National Pollutant Discharge Elimination System (NPDES) permitting. However, the need for consultation to determine the extent of permits necessary under CWA or other similar or related regulatory requirements is noted in the table below.

Table 5-1. Potential Regulatory Needs and Considerations for Study Alternatives

| Regulatory Requirement | Regulatory Agency or Entity |
|--|--|
| Federal | |
| Clean Water Act Consultation | U.S. Army Corps of Engineers, Nevada Department of Environmental Protection, and Pyramid Lake Paiute Tribe |
| Cultural Resources Consultation | Nevada State Historic Preservation Office |
| Endangered Species Act Consultation | U.S. Fish and Wildlife Service |
| Farmland Protection Policy Act | Natural Resources Conservation Service |
| Fish and Wildlife Coordination Act Consultation | U.S. Fish and Wildlife Service |
| Floodplain Management (Executive Order 11988), Protection of Wetlands (Executive Order 11990), and Federal Noxious Weed Control Act (Executive Order 13112, and 43 CFR 46.215 (l)) | Various |
| Indian Trust Resources Consultation | Pyramid Lake Paiute Tribe and Fallon Paiute-Shoshone Tribe |
| Migratory Bird Treaty Act (16 U.S.C. 703 et seq.) | U.S. Fish and Wildlife Service |
| National Environmental Policy Act | The lead Federal agency would be determined at a later date, but may be assumed to be Reclamation. |
| Rivers and Harbors Act Section 10 | U.S. Army Corps of Engineers |
| State | |
| Construction Stormwater Permit | Nevada Division of Environmental Protection, Bureau of Water Pollution Control |
| Surface Area Disturbance Permit | Nevada Division of Environmental Protection, Bureau of Air Pollution Control |
| Working in Waterways Permit | Nevada Division of Environmental Protection, Bureau of Water Pollution Control |
| Local | |
| Encroachment permits | Churchill, Lyon, and Storey counties |

Key:

CFR = Code of Federal Regulations

U.S.C. = United States Code

Financial and Economic Analysis

An analysis was performed to assess TCID's overall financial condition and estimate TCID's ability to pay for the cost of actions to meet the safety and water supply objectives. Additionally, preliminary benefit categories were identified, and water supply-based economic benefits were quantified to determine the value of water supply to different categories of water uses in the Project. Quantitative analyses of anticipated economic benefits such as safety, and the effects of the alternatives on the regional economy, were beyond the scope of this Study.

TCID Ability-to-Pay

For the purposes of alternatives evaluation and comparison, the financial analysis included development of TCID's ability-to-pay under each Study alternative. Ability-to-pay is defined as the farm-level payment capacity aggregated to the entire Project plus TCID's hydropower revenues and non-operating revenues, minus TCID's O&M costs, existing obligations, operations and maintenance costs, power costs, and reserve fund requirements. Analyses used to estimate TCID's ability-to-pay include:

- **Farm Payment Capacity** – Payment capacity is the estimated residual net farm income of irrigators after deduction for on-farm production and investment expenses, as well as appropriate allowances for management, equity, and labor. The Payment capacity analysis is intended to estimate the financial ability of farms to absorb additional water supply and management costs. For this analysis, farm crop budgets were prepared representing common crop rotations and several sizes of commercial farming operations within the Project. Available water supply for each Study alternative is assessed to determine if the changes in irrigation water supply result in changes in payment capacity.
- **Hydropower** – TCID operates two hydropower plants that generate power as water is delivered to farms and others in the Project. Electricity sales from power generation provide an important ongoing source of income to TCID. The water supply model provides estimates of power generation at the facilities according to water deliveries within the Carson Division. The power generation estimates are combined with electricity price information contained in the power sale contracts held by TCID to estimate annual power revenues for each alternative.
- **Financial** – The financial model combined financial statements for the most recent five-year period with output from the hydropower model and payment capacity analysis to estimate TCID's ability to pay.

As reported in Appendix G1, "Financial and Economic Analysis," the estimated current ability of TCID to pay for projects and improvements beyond current obligations is \$6.50 million per year. The ability to pay currently and under each alternative relies substantially upon current and recent crop prices, which are volatile. For example, if alfalfa prices fell from current levels (\$155 per ton) to levels experienced a decade ago (\$125 per ton), TCID's ability to pay could be reduced by as much as \$8.7 million per year. Ability to pay estimates represent potential maximum increases to charges that TCID could apply to their customers and maintain farm profitability, and are not reasonable to use as the sole basis for capital investment decisions.

A full description of this process and related assumptions, as well as information related to TCID's overall financial condition, is found in Appendix G1.

Preliminary Benefits Estimates

Five categories of benefits were identified in relation to the Study alternatives to illustrate the potential economic effects of the alternatives: safety, hydropower generation, and water supply for agricultural, M&I, and environmental/wetlands uses. Where, possible, these benefits have been quantified for the Study alternatives in relation to the Without-Action Alternative.

The economic analyses conducted for this Study are preliminary, and less detailed than what would be anticipated for a full feasibility study. It is widely recognized that the Truckee Canal has a strong influence on the regional economy. However, an evaluation of the regional incidence of economic effects, income transfers, and employment, which would be reported under the Regional Economic Development (RED) account in a feasibility study, is beyond the scope of this Study.

Safety Reclamation has found that the Without-Action Alternative likely reduces some portion of risk along the urbanized portions of the Truckee Canal near the City of Fernley. All of the Study Alternatives have been designed to meet the RR3 standard of safety, and are assumed to perform equally in this capacity.

Economic studies of alternatives that seek to improve public safety or reduce the occurrence of flooding often estimate the value of these improvements though "life safety" or "flood damage reduction." However, quantitative evaluation of these benefits has not been performed and is beyond the scope of this Study. The City of Fernley is the primary beneficiary from the safety improvements to the Truckee Canal in terms of reduced flood risk, but addressing the safety concerns in the Truckee Canal is also closely tied to the water supply benefits, as it would allow the canal to be operated at a higher capacity and provide a more reliable water supply for the Project.

Agricultural Water Supply The benefits of agricultural water supply reliability provided by the alternatives are the increase in value of agricultural outputs (crop yields), when comparing Study alternatives to the Without-Action Alternative. To estimate the direct economic value from additional water supply reliability to agricultural users in the Project, the Study applied the payment capacity analysis results as a preliminary measure of the agricultural benefits of the alternatives. The benefits to noncommercial farms are estimated as the weighted average benefits estimated for commercial farms, consistent with the payment capacity analysis described above and in Appendix G1. The benefits are measured as the increase in value between the Without-Action Alternative and the Study alternatives. The adjustments made to reach the

agricultural water supply benefit under each Study alternative is reported in Appendix G2, “Preliminary Benefits Estimation.”

M&I Water Supply The M&I water supply benefits analysis applies observed water right market prices within the Truckee and Carson divisions to estimate M&I benefits. This approach is consistent with the “cost of the most likely alternative” approach in the P&G as agricultural water rights are commonly acquired by municipal water providers and real estate developers for M&I uses. The economic value has been estimated at a unit price of \$1,500 per acre-foot for the Carson Division, and between \$4,000 and \$6,000 per acre-foot for the Truckee Division. The benefits are estimated as the difference in economic value between the Study alternatives and Without-Action Alternative. Development of these values is described in Appendix D8, “Market Value of Non-diverted Water Under a 0 cfs Truckee Canal,” and Appendix G2, “Preliminary Benefits Estimation.”

Environmental/Wetlands Water Supply To estimate the benefits associated with changes in water supply for environmental uses, this analysis considers the costs associated with developing alternative sources of environmental water supply to support wetland functions in the Carson Division. The USFWS has been purchasing water rights from willing agricultural sellers for many years to augment water supplies to wetlands, and the value of the benefit of water supply to Lahontan Valley wetlands is based on USFWS water rights purchases. Changes in water supply (Project deliveries and spills from Lahontan Dam) associated with the Study alternatives may result in a corresponding increase or reduction in water right acquisition volume to achieve wetland water supply goals. As a result, the costs associated with the water right purchases are used in this analysis as a preliminary indication of the benefits. This benefit has been estimated to a unit price of \$1,756 per acre-foot, as reported in Appendix G2, “Preliminary Benefits Estimation.”

This analysis does not factor in added or reduced benefits due to potential changes in groundwater or drain flows that may result from implementation of actions in certain Study alternatives. Drain flows provide a portion of usable flows for the wetlands estimated at about 3,000 to 5,000 acre-feet per year (Richard Grimes, USFWS, personal communication, January 6, 2012).

Hydropower The hydropower benefit is the increase in revenue from hydropower generation that may result under different Study alternatives as compared to the Without-Action Alternative. Development of these estimates is described in Appendix G1, “Financial and Economic Analysis.”

Implementation Considerations

A variety of potential actions, responsibilities, and participants may be involved in implementing any of the alternatives, depending on an alternative’s components and features.

For each alternative, the Study has provided a preliminary assessment of the alternative's compatibility with existing laws, policies, and plans. All the alternatives have been formulated to respect current State and Federal laws and policies, and are compatible with OCAP. Necessary regulatory or environmental compliance is also noted, but also described in the "Environmental Outcomes" and "Regulatory Review" subsections of this chapter.

Additionally, each description identifies the range of agencies or other entities who might be involved in implementation or cost-sharing. While Reclamation would likely participate in any action related to the Newlands Project, other Federal agencies, State agencies, local or regional agencies, and tribes could also participate in significant portions of an alternative's planning and implementation. Typically, Federal planning processes identify potential non-Federal partners to share the cost of implementing an alternative based on the relative benefits received by the potential partners. Such costs could include planning, permitting, construction, and occasionally O&M costs for the completed project. This Study does not attempt to allocate specific costs to be paid by different entities under each alternative; rather, the evaluation for each alternative merely notes those entities who might participate as a cost-share partner with Reclamation based on the benefits they receive or based on other specific interests.

Without-Action Alternative

The Without-Action Alternative represents future conditions that are likely to occur if none of the action alternatives are implemented, and is the basis for comparison with potential action alternatives, consistent with the P&G. It is intended to account for existing facilities, conditions, land uses, and reasonably foreseeable actions expected to occur in the primary study area in the future. Reasonably foreseeable actions include actions with current authorization, secured funding for design and construction, and/or environmental permitting and compliance activities that are substantially complete. Thus, if no action is selected for implementation by the Federal government, local governments, or other parties, the Without-Action Alternative is the likely default option.

The likely future restriction on the Truckee Canal's capacity is a central feature in the Study's Without-Action Alternative. Consistent with Federal planning guidelines, the Without-Action Alternative represents the likely future conditions – including the anticipated implementation of programs and projects that are authorized and funded – if no proposed action is taken. At present, there are no funded plans for reducing the identified risks on the Truckee Canal.

Components and Features

Under the Without-Action Alternative, the Truckee Canal is restricted to a 150 cfs flow stage within the Fernley Reach, consistent with Reclamation's allowance following the 2008 Truckee Canal breach (see the "Infrastructure" and "Water Resources" sections of Chapter 3).

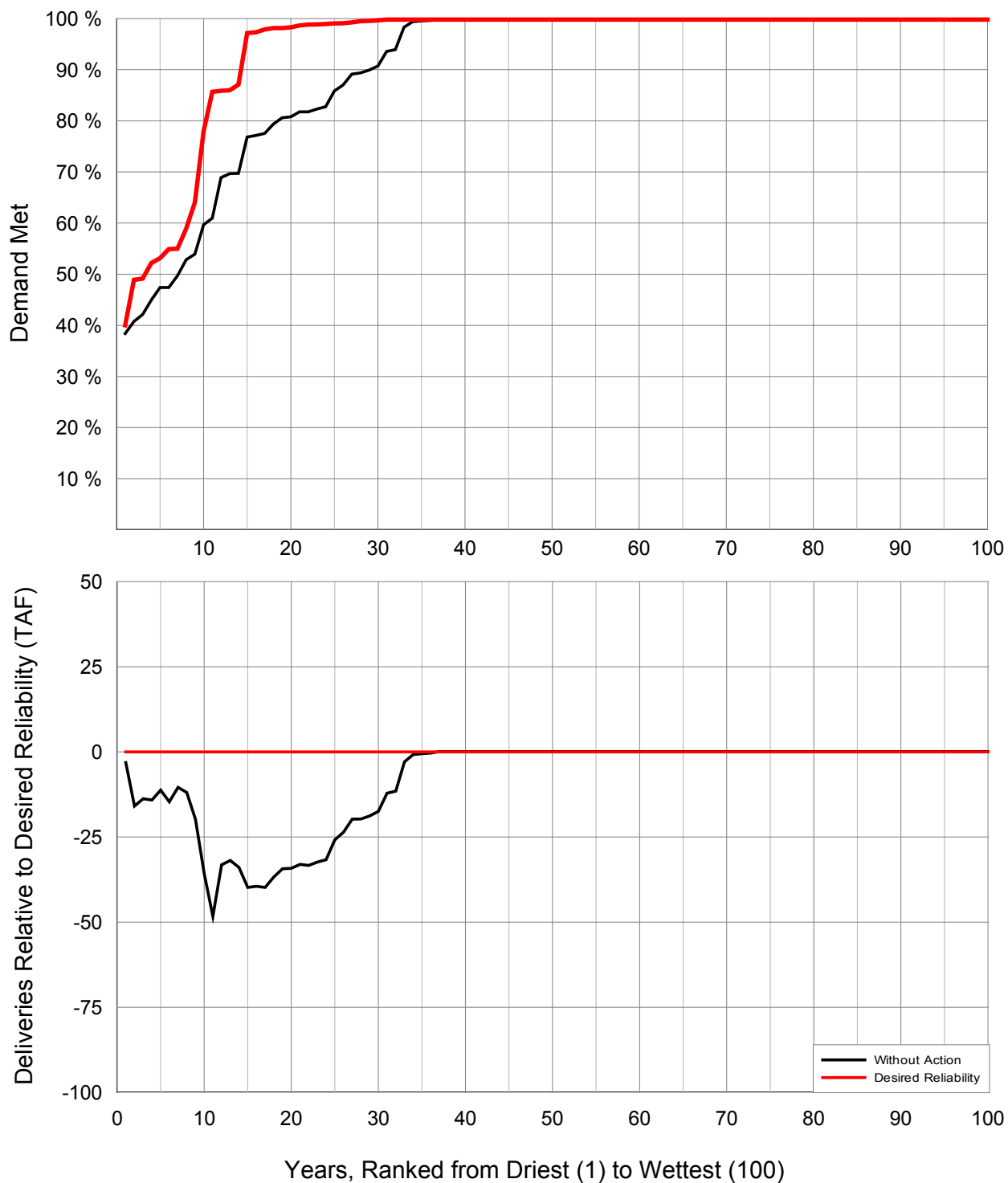
Accomplishments

Safety

The degree to which the Without-Action Alternative includes a safe flow stage in the Truckee Canal is uncertain. The 150 cfs flow stage is believed to pose a lower risk to the Fernley area. By operating the canal features to limit the flow stage to 150 cfs through the Fernley Reach, the water elevation in the canal is maintained at a level low enough to minimize the risk of destabilizing the canal embankment due to animal burrows and other pathways that might encourage internal erosion of the structure. However, this is not a solution specifically designed to reduce risk of operating the canal, and thus the degree to which it meets the Study's safety objective (RR3) is unknown.

Water Supply

The Without-Action Alternative does not meet either of the two conditions needed to achieve the Study's water supply objective: (1) the long-term average delivery of Project water (90.5 percent) is less than the desired reliability (94.6 percent); (2) as shown in Figure 5-1, the largest annual difference in supply relative to the Desired Reliability scenario is approximately negative-48,000 acre-feet, which exceeds the desired negative-10,000 acre-foot threshold.



Key:
TAF = thousand acre-feet

Figure 5-1. Water Supply Performance of the Without-Action Alternative

Project Efficiency

Project efficiency is assumed to be 65 percent and is unchanged under the Without-Action Alternative.

Water Quantity and Quality on Lower Truckee River

The Desired Reliability represents the historical hydrology and current operating conditions for the Newlands Project. With this condition, the annual average lower Truckee River flow volume is 470,000 acre-feet. The Without-Action Alternative, which diverts less water into the Truckee Canal than under the Desired Reliability, increases this volume to an annual average of 516,000 acre-feet on the lower Truckee River.

Hydropower Generation

The long-term average annual hydropower generation is estimated to be 13,906 megawatt hours (MWh) at Lahontan Powerplant and 4,561 MWh at 26-Foot Drop Powerplant in the Without-Action Alternative. This is significantly lower than the average annual generation under current conditions, which is approximately 16,500 MWh (see Appendix B3).

Preliminary Alternative Review

Under the Without-Action Alternative, Truckee Canal flows would be lower than under current conditions. As a result, Truckee River flows below Derby Dam and inflows into Pyramid Lake would be higher than current levels. Lahontan Reservoir inflows and releases into the Carson Division would be lower than current conditions.

Environmental Outcomes

Under the Without-Action Alternative, listed fish in the Truckee River and Pyramid Lake would benefit from increases in water quantity and quality as compared to current conditions. Wetlands and riparian resources in the vicinity of the Truckee River and Pyramid Lake would also receive benefits of increased water availability. Other fish and wildlife that depend on wetland and riparian resources in the Truckee River and Pyramid Lake would benefit from these changes in habitat. In contrast, wetland and riparian areas adjacent to the Lahontan Reservoir and Carson Lake may decrease in extent due to lower water availability. Non-listed fish species and other wildlife species that use the Lahontan Reservoir and Carson Lake would experience decreases in water quality and quantity (Reclamation 2000).

As compared to the current and historical conditions, the Without-Action Alternative would be expected to have some effects on the local and regional economy, with potentially less long-term agricultural production. Additionally, it is likely that Fernley's M&I water supply, which currently is derived from groundwater, would be substantially reduced under the Without-Action Alternative (City of Fernley 2012).

No agricultural land retirement or fallowing is planned to occur under this scenario; rather, it is assumed that water efficiencies, including reuse of agricultural drain water, would increase to offset decreases in the quantity of water available for diversion. The reduction in irrigation return flows would reduce groundwater availability, as compared to current levels.

No substantial changes in land use or land cover are anticipated to occur under this scenario; therefore, no substantial changes in air quality from agricultural activities or changes in the extent of fallow land are expected to occur.

No construction would be associated with this scenario; therefore, tree removal would not be required, and no short-term effects to air quality or noise would result from equipment usage.

Regulatory Review

No construction activities or administrative changes are proposed under this alternative; therefore no regulatory compliance activities would be required.

Economics

TCID Ability to Pay

Under the Without-Action Alternative, TCID's ability to pay is estimated at \$5 million annually. This assessment represents an approximately 23 percent reduction in ability to pay from current conditions (\$6.5 million).

Implementation Considerations

See the "Regulatory Review" section above. No implementation considerations would be relevant under the Without-Action Alternative, as implementation activities are not required.

Alternative 600

Components and Features

The safety measure for Alternative 600 also meets the water supply objective. The allowable maximum flow stage in the Truckee Canal under this alternative, 600 cfs, fully meets the future demand of the Project.

Safety

HDPE Cutoff Wall The primary action to achieve safety is to install a HDPE cutoff wall within the Truckee Canal's embankment in:

- 1.7 miles of the Derby Reach of the canal (between Truckee Canal station (STA) 409+75 to 411+00, 418+00 to 425+00, 433+00 to 445+00, 469+00 to 502+00, and 525+00 to 543+10)
- The entire Fernley Reach (11.1 miles, from STA 543+10 to 1126+40)

- 4.2 miles of the Lahontan Reach (from STA 1126+40 to 1260+00, 1270+00 to 1288+00, 1294+00 to 1300+00, and 1302+00 to 1340+00)

Truckee Canal station locations noted above can be located on Figures 5-2 through 5-4.

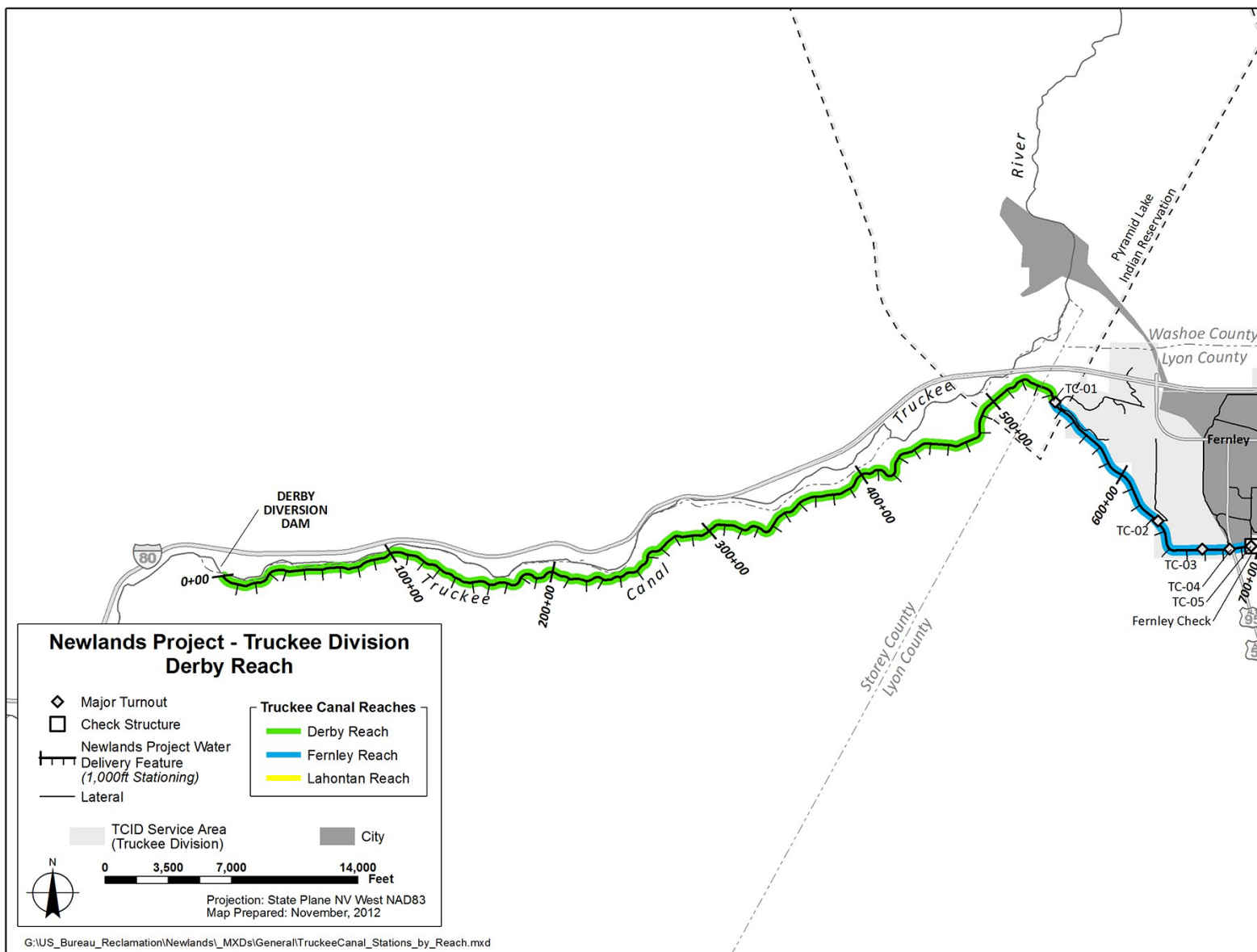


Figure 5-2. Truckee Canal Stationing, Derby Reach

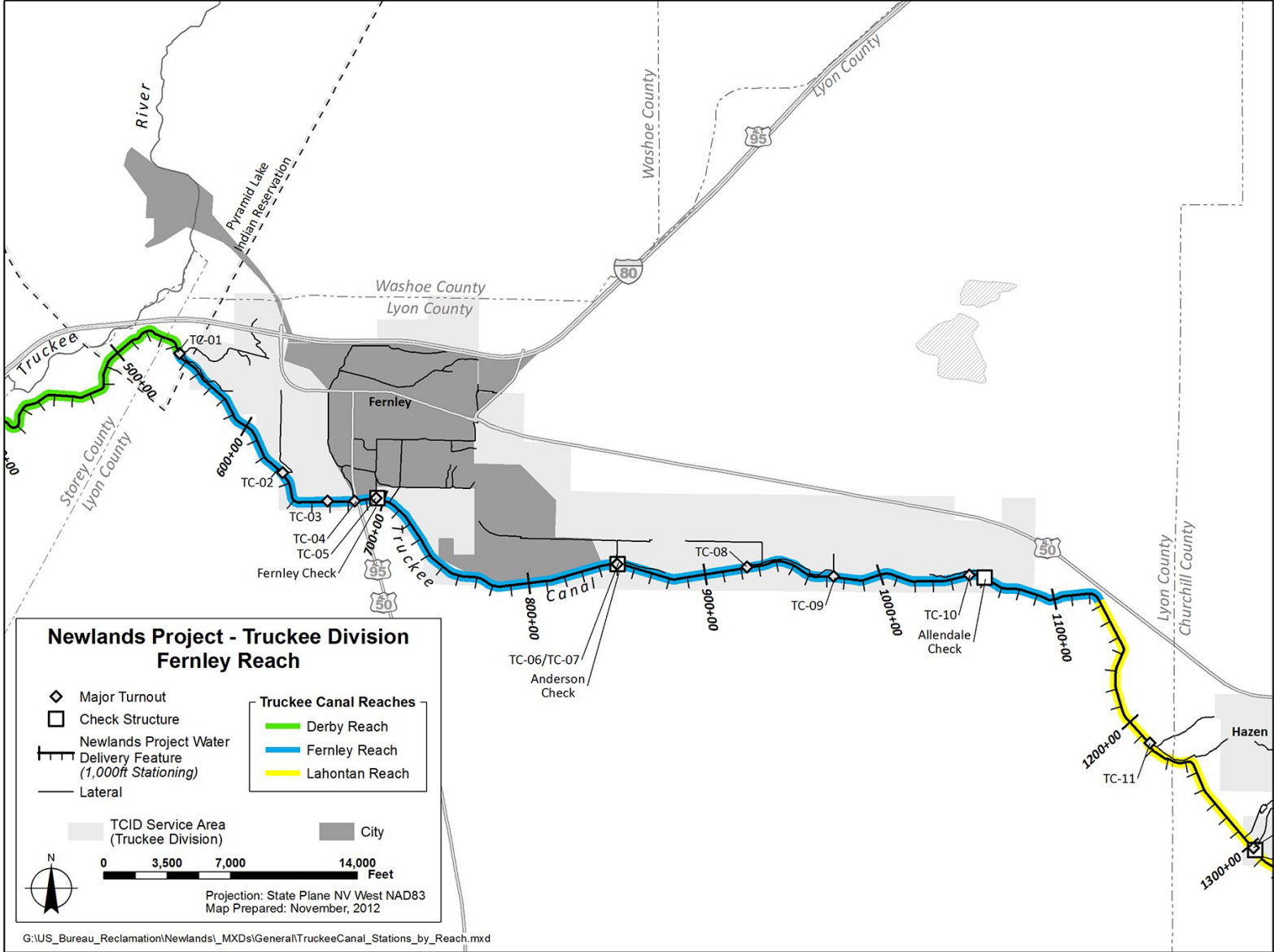


Figure 5-3. Truckee Canal Stationing, Fernley Reach

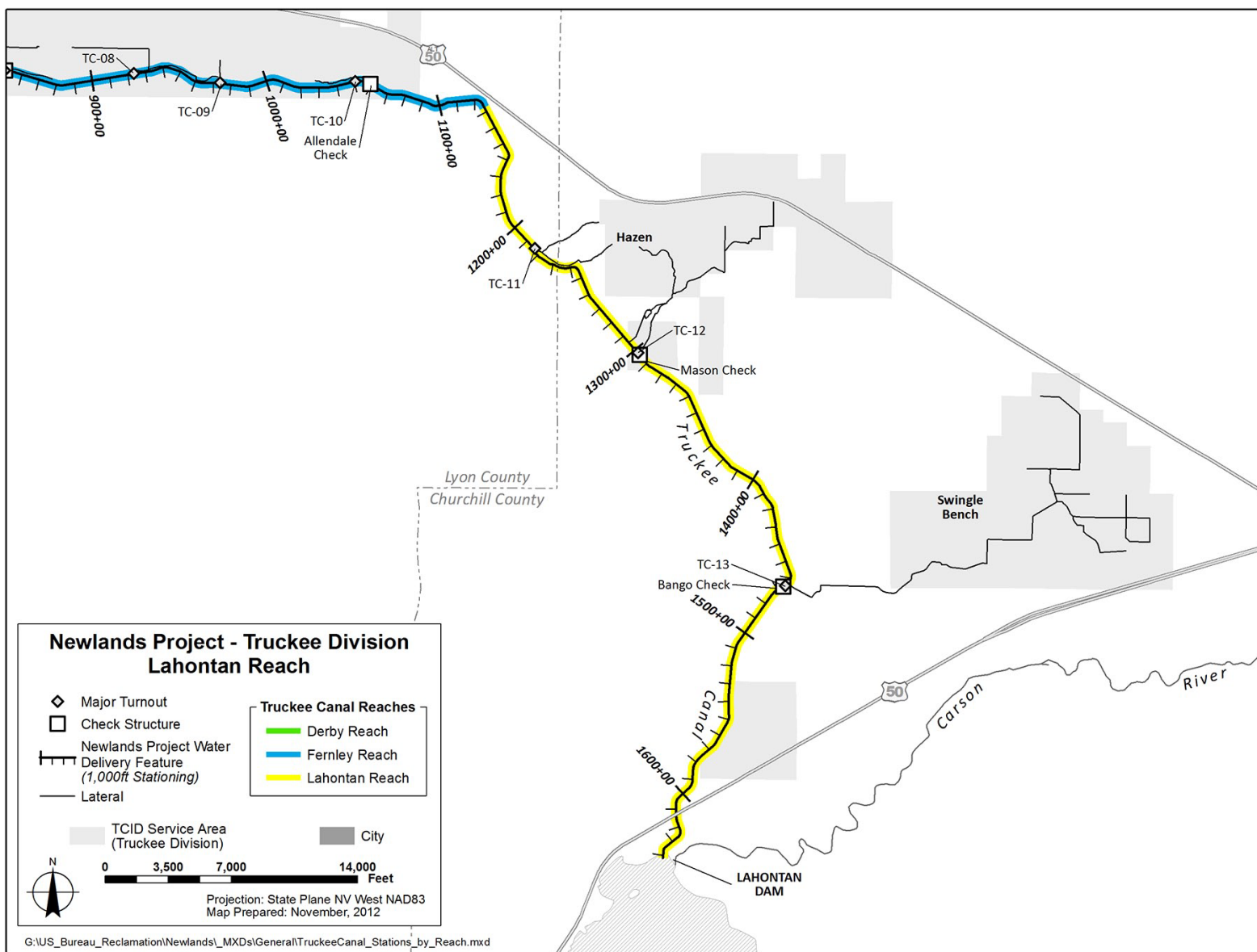


Figure 5-4. Truckee Canal Stationing, Lahontan Reach

The HDPE wall would provide a vertical barrier against seepage through the canal through the installation of panels joined with an interlocking system at each joint. The HDPE wall would be pushed and vibrated into the centerline of the canal. No trenching would be needed for installation.

Other Structural Improvements Additional actions to achieve the safety objective for this alternative:

- Replace each turnout pipe in the canal: nine in the Fernley Reach (at STA 578+66, 641+09, 668+58, 695+60, 728+50, 822+13, 848+82, 1003+54, and 1057+84) and two in the Lahontan Reach (at 1302+39 and 1465+06). The turnouts would be designed with the appropriate canal water surface elevation for delivering the required turnout flows. A new turnout structure with slide gate will be installed with the required pipe diameters designed to deliver the flow needed. A sand filter collar would be installed along a portion of the outlet side of the pipe. Riprap protection within the canal bank on either side of the structure would prevent animals from burrowing around the structure.¹
- Replace all stock water line systems, and combine existing stock watering pipes with the new turnouts where applicable.¹
- Replace four check structures in the Fernley Reach (Fernley, Anderson, and Allendale checks) and Lahontan Reach (Mason Check) with new, automated check structures.
- Remove the abandoned Pyramid (Derby) Check.
- Install a new check structure upstream from TC-1.
- Install five cross-drainage structures in the Derby Reach (at STA 28+00, 93+00, 180+00, 266+65, and 464+50).
- Install 10 wasteway turnout structures in the Fernley Reach (STA 544+33, 589+53, 633+70, 684+00, 795+15, 850+14, 923+58, 973+70, 1050+40, and 1100+00).
- Increase the canal bank height along 1.9 miles of the Lahontan Reach (from STA 1200+00 to 1302+00).
- Install a concrete geomembrane lining system over each utility crossing.

¹ These actions were identified by Reclamation in the Corrective Action Study (Reclamation 2011e) before TCID replaced the Truckee Canal's turnouts with new structures that include both stock line and delivery features. This canal conduit rehabilitation work occurred in 2012 and likely satisfies a portion of the safety objective the alternatives seek to achieve.

- Remove up to 115 trees located within 15 feet of the downstream toe of the landside slope in the Fernley and Lahontan reaches.

Replacement of existing canal appurtenance structures and new canal appurtenance structures provides risk reduction for several Truckee Canal failure modes (see Chapter 3). The cross-drainage structures will convey rainfall runoff across the canal and into the Truckee River in the Derby Reach. The new check structures will replace the existing checks to provide large check openings and gates to pass ice-jammed flows and flood flows. They will also allow for elevated water levels above the normal operating level to bypass the check gates by overflowing weirs on either side of the gates. The wasteway turnout structures combine an overflow weir and turnout into one structure that provides protection against overtopping of the canal, as well as normal diversion delivery flow to irrigators.

Cost Estimates

The total annual cost for Alternative 600 is \$2.9 million.¹ The following table identifies estimates for non-contract costs; and total construction, capital, and annualized costs.

¹ This cost does not reflect a potential reduction that may result from TCID's 2012 activities to replace turnout structures on the Truckee Canal. Replacement of these structures likely satisfies a portion of the actions to achieve the safety objective and could reduce the field cost by \$1.7 million, which is not reflected here.

Table 5-2. Alternative 600 Cost Summary

| Measure Selected for Meeting the Safety Objective | Additional Measure(s) Selected for Meeting the Water Supply Objective | Estimated Cost (\$ Million) |
|--|---|-----------------------------|
| HDPE Cutoff Wall | | \$44.0 |
| | no additional measures selected | - |
| TOTAL FIELD COST | | \$44.0 |
| Non-Contract Costs | | |
| Planning and Environmental Compliance ¹ | | \$4.40 |
| Engineering and Design ² | | \$4.40 |
| Construction Management ³ | | \$4.40 |
| Easements ⁴ | | \$0.45 |
| Cultural Resources ⁵ | | \$1.35 |
| TOTAL CONSTRUCTION COST | | \$59.0 |
| Interest During Construction ⁶ | | \$2.00 |
| TOTAL CAPITAL COST | | \$61.0 |
| Interest and Amortization ⁷ | | \$2.80 |
| Annual Operations and Maintenance ⁸ | | \$0.10 |
| TOTAL ANNUAL COST | | \$2.90 |

Note:

Cost estimate is appraisal-level and subject to change in the future. Appraisal-level cost estimates are not suitable for requesting project authorization and/or construction fund appropriations. Cost estimate is presented in January 2012 dollars, and may have discrepancies due to rounding.

¹ 10 percent of the field cost was estimated for Planning and Environmental Compliance non-contract costs.

² 10 percent of the field cost was estimated for Engineering and Design non-contract costs.

³ 10 percent of the field cost was estimated for Construction Management non-contract costs.

⁴ 1 percent of the field cost was estimated for Easements non-contract costs.

⁵ 3 percent of the field cost was estimated for Cultural Resources non-contract costs.

⁶ Interest During Construction was estimated over 2 years of construction at the current Federal discount rate of 4 percent.

⁷ Interest and Amortization of the capital cost was estimated over 50 years at the current Federal discount rate of 4 percent.

⁸ Annual Operations and Maintenance costs were estimated at 0.2 percent of the field cost.

Key:

\$ million = million dollars

HDPE = high-density polyethylene

Accomplishments

Safety

Alternative 600 and all other alternatives formulated and selected by the Study meet the RR3 level of risk reduction required to achieve the Study's safety objective.

Water Supply

Alternative 600 meets or exceeds both of the conditions needed to achieve the Study's water supply objective: (1) the long-term average delivery of Project water (96.5 percent) exceeds that of the Desired Reliability scenario (94.6 percent); and (2) as shown in Figure 5-5, deliveries for Alternative 600 exceed those for the Desired Reliability for each of the 100 years evaluated.

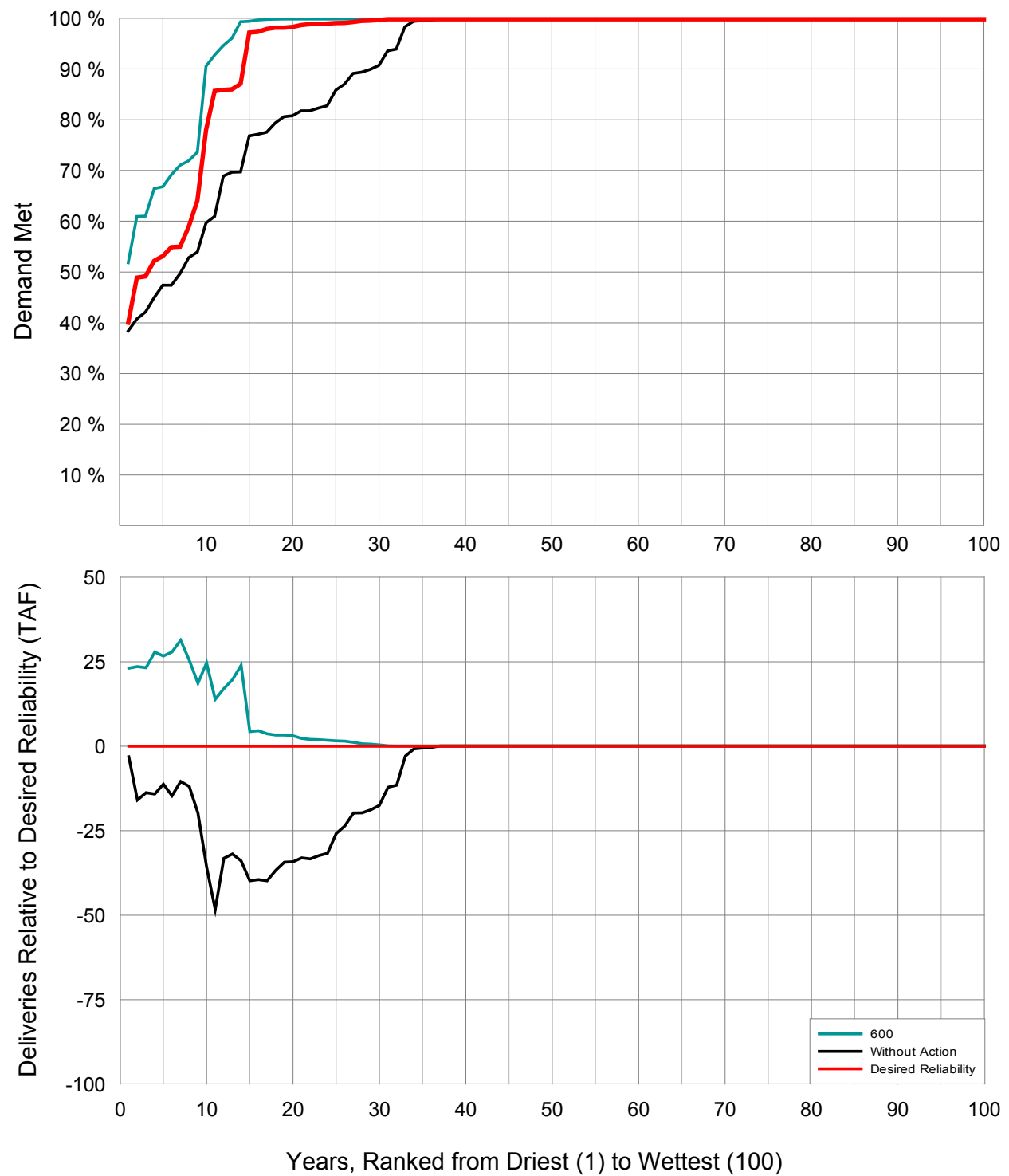


Figure 5-5. Water Supply Performance of Alternative 600

Project Efficiency

Alternative 600 plans for a Project efficiency of 65 percent, and includes no actions to increase efficiency.

Seepage losses from the Truckee Canal are not reduced under this alternative.

Water Quantity and Quality on Lower Truckee River

The average annual volume of water in the lower Truckee River does not differ greatly between the Desired Reliability condition and Alternative 600.

- **Relative to the Desired Reliability** – Increase in Truckee River flow of 10,000 acre-feet annually.
- **Relative to the Without-Action Alternative condition** – Decrease in Truckee River flow of 36,000 acre-feet annually.

Hydropower Generation

Hydropower generation is increased under Alternative 600 relative to the Without-Action Alternative. Average generation at Lahontan Powerplant and 26 Foot Drop powerplant is 16,227 MWh and 4,920 MWh annually, respectively.

Preliminary Alternative Review

Under Alternative 600, the volume of water diverted into the Truckee Canal would be greater than under the Without-Action Alternative. As a result, wetlands and environmental conditions in the Project would be improved. Relative to Without-Action Alternative, Lahontan Reservoir inflows would increase and the volume of water in the Truckee River below Derby Dam and inflows into Pyramid Lake would decrease. Safety modifications to the Truckee Canal required to accommodate the flow would trigger regulatory compliance requirements.

Environmental Outcomes

Compared to the Without-Action Alternative, under Alternative 600, wetland and riparian areas adjacent to the Lahontan Reservoir and Carson Lake may increase in extent due to greater water availability. Fish species and other wildlife species that use the Lahontan Reservoir and Carson Lake would experience increases in water quality and quantity that may improve habitat quality and prey availability. Listed fish in the Truckee River and at Pyramid Lake would experience decreases in water quantity and quality under Alternative 600 as compared to the Without-Action Alternative. Wetlands and riparian resources in the vicinity of the Truckee River and Pyramid Lake may decrease in extent due to decreased water availability. Other fish and wildlife that depend on wetland and riparian resources in the Truckee River and Pyramid Lake could be adversely affected by these changes in habitat.

Under Alternative 600, return flows and groundwater availability may increase in the Carson Division compared to under the Without-Action Alternative.

Increased water availability within the Carson Division and return flows from agricultural users would benefit Stillwater NWR. No substantial changes in land use or land cover are anticipated to occur under this scenario; therefore, no substantial changes in air quality from agricultural activities or changes in the extent of fallow land are expected to occur.

The City of Fernley relies on seepage from the Truckee Canal to replenish the local aquifer, which is used for municipal and industrial water. Studies have estimated that a minimum flow of 350 cfs is needed in the Truckee Canal to accommodate the level of aquifer recharge required for the City of Fernley to continue receiving an adequate level of municipal water withdrawals (City of Fernley 2012). The 600 cfs alternative meets the City of Fernley's aquifer recharge needs, although this is not a valid Project delivery. Appendix B4 contains correspondence between Reclamation and the City of Fernley regarding Fernley's reliance on seepage from the Truckee Canal.

Construction effects from the Truckee Canal safety improvements could result in temporary effects to air quality from construction machinery, primarily related to fugitive dust from traveling on unpaved roadways adjacent to canals, and increased noise levels. Because the Truckee Canal is part of the NRHP-listed Newlands Project, planned improvements would need to be evaluated to determine that they do not negatively affect the aesthetics of historical importance of structures. Construction activities could affect water quality by the introduction of sediment and petrochemicals from machinery. The majority of the construction activities would occur in moderately populated areas, and there is potential for construction noise to disturb nearby residents in some places. It is assumed that noise mitigation measures, such as construction work windows and/or muffling of equipment would occur, if necessary.

Regulatory Review

A list of Federal, State, and local regulations that may be applicable to all alternatives is summarized in Table 5-1.

Federal Requirements Due to the presence of LCT and cui-ui in the extended study area, it is expected that Reclamation would initiate informal consultation with USFWS to determine any potential compliance requirements related to the ESA. Although it is not anticipated at this time, if it is determined that there is potential for adverse effects to listed fish, formal consultation and a biological assessment would be required. Informal consultation with USFWS would also address potential effects to non-listed species covered under the Migratory Bird Treaty Act or Fish and Wildlife Coordination Act from habitat changes, such as potential land bridge formation in Lahontan Reservoir and removal of trees that could provide nesting and roosting habitat.

Consultation would also occur with the USACE, although the Newlands Project has been exempt from certain provisions of the CWA. Therefore, it is not certain to what extent USACE permits would be required. Consultation would

be required to address potential effects associated with Indian Trust Assets because some construction activities may take place on Pyramid Lake Paiute Tribal land or could indirectly affect Fallon Paiute Shoshone Tribe resources in the extended study area.

Because the Newlands Project is listed in the NRHP, consultation with the Nevada SHPO would be required to identify and mitigate potential negative effects to historic structures.

NEPA compliance would be required to assess the environmental effects of the proposed alternatives. Because no administrative changes in water rights are expected, and construction effects would not be extensive, an Environmental Assessment (EA) may be determined to be sufficient to evaluate effects. A public scoping process would be included as part of the NEPA process.

State and Local Requirements State and local permits would be required for construction-related activities, including a Surface Area Disturbance Permit from the Nevada Department of Environmental Protection (NDEP), Bureau of Air Pollution, if over 5 acres are disturbed. Consultation would also occur with NDEP, Bureau of Water Pollution Control, to determine State regulatory requirements and necessary permits related to water quality. If Truckee Canal safety improvements occur within a county right-of-way or road easement (within 30 feet of a county road), an encroachment permit would be required from Lyon, Storey, or Churchill counties.

Economics

TCID Ability to Pay

Under Alternative 600, TCID's ability to pay is estimated at \$7.30 million annually. This is an improvement over the Without-Action Alternative of approximately \$2.30 million.

Preliminary Benefits

All preliminary benefits for Alternative 600 are estimated in relation to conditions under the Without-Action Alternative. Although not quantified in the Study, safety to the City of Fernley is a primary benefit of Alternative 600. Benefits to agricultural, wetlands and M&I water supplies factor in the average water supply reliability of 96.5 percent that occurs under Alternative 600. Average annual revenue from hydropower generation increases \$0.18 million over the Without-Action Alternative. The annual benefit of increased agricultural water supply for the Project is estimated at \$1.20 million. The annual benefit of increased supply to wetlands is \$0.51 million. The annual benefit of increased M&I supply is estimated at \$0.01 million.

Implementation Considerations

Compatibility with Applicable Laws, Policies, and Plans

Alternative 600 is anticipated to be compatible with all existing laws and policies. It is also compatible with recent Truckee Canal rehabilitation actions taken by TCID to remove the 33 existing conduits to the laterals and replace them with 17 structures that include both lateral and stock line delivery features (TCID 2012b).

The range of environmental outcomes is more limited under this alternative than other alternatives evaluated, and may be able to be evaluated in an EA (see “Preliminary Alternative Review” subsection above).

Federal and Non-Federal Roles and Responsibilities

Reclamation would likely be the Federal lead for permitting and NEPA compliance. As the local contractor, TCID would likely obtain State and local permits related to construction activities.

Potential for Cost-Sharing

TCID TCID should be considered a potential cost-share partner because Alternative 600 significantly increases the water supply reliability experienced by its customers, which in turn improves its hydropower generation capacity – one of the largest sources of annual revenue for the district.

City of Fernley The City of Fernley should be considered as a potential cost-share partner for this Study alternative. The benefit of life safety and averted flood damage reduction would serve as a portion of the benefit that the city derives from Alternative 600. Additionally, Fernley receives the incidental benefit of continued seepage from the Truckee Canal into the local aquifer. By implementing this alternative, instead of another alternative that lines the Truckee Canal and reduces seepage, the city avoids the cost of replacing the groundwater supplies that they rely on.

Summary of Alternative 600

Table 5-3 below summarizes the performance, accomplishments, benefits, costs, and other characteristics of Alternative 600.

Table 5-3. Characteristics of Alternative 600

| | | Alternative 600 | Without-Action Alternative | Desired Reliability Scenario |
|--|--|------------------------------------|---|-------------------------------------|
| Major Features | Truckee Canal Flow Stage | 600 cfs | 150 cfs | 900 cfs |
| | Truckee Canal HDPE Cutoff Wall or Lining | HDPE Cutoff Wall | - | NA |
| | Other Features | - | - | NA |
| Safety | | Meets RR3 | Uncertain ¹¹ | NA |
| Average Annual Project Water Delivery¹ (percent) | | 96.5% | 90.5% | 94.6% |
| Average Annual Project Water Delivery by User Category | Ag/Irrigation (TAF) | 118.3 | 111.2 | NA |
| | M&I (TAF) | 13.3 | 13.2 | NA |
| | Lahontan Valley Wetlands ² (TAF) | 68.0 | 63.6 | NA |
| Annual Cost³ (millions) | | \$2.90 | NA | NA |
| TCID Ability-to-Pay¹² (millions) | | \$7.30 | \$5.00 | NA ⁹ |
| Preliminary Benefits⁵ (annual) | Agricultural Water Supply Reliability (millions) | \$1.20 | NA | NA |
| | Wetlands/ Environmental Water Supply Reliability ⁴ (millions) | \$0.51 | NA | NA |
| | M&I Water Supply Reliability (millions) | \$0.01 | NA | NA |
| | Hydropower Generation Revenue (millions) | \$0.18 | NA | NA |
| | Safety ⁶ | Increased | NA | NA |
| Environmental and Other Effects | Avg. Annual Spill to Stillwater NWR from Lahontan Dam (TAF) ⁷ | 12.6 | 11.0 | 12.5 |
| | Carson Division Groundwater and Agricultural Drain Flows ¹⁰ | Significant change not anticipated | Reduced in comparison to current conditions | Similar to current conditions |
| | City of Fernley Demand Met ⁸ (percent) | 115% | 99% | 121% |
| | Avg. Annual Flow to Pyramid Lake (TAF) | 480 | 516 | 460 ¹³ |

Table 5-3. Characteristics of Alternative 600 (contd.)

Notes:

- ¹ Long-term average annual percent of Newlands Project demand met.
- ² Includes deliveries to Carson Lake and Pasture, the Fallon Paiute-Shoshone Tribal wetlands, and Stillwater NWR.
- ³ Annual costs include interest and amortization of the capital cost estimated over 50 years at the current federal discount rate of 4 percent. Costs also include annual operations and maintenance estimated at 0.2 percent of the field cost. For some alternatives with the Dry-Year Fallowing, annual costs for the program were estimated at \$100 per acre of land fallowing plus an administrative cost at 20 percent of the fee. For additional information, see Appendix E3.
- ⁴ Based on volume of deliveries to Carson Lake and Pasture, the Fallon Paiute-Shoshone Tribal wetlands, and Stillwater NWR, and also spills to Stillwater from Lahontan Dam. Excludes consideration of water supply from return flows and groundwater.
- ⁵ Preliminary benefits were estimated as the change between a Study alternative and the Without-Action Alternative for agricultural water supply, wetlands water supply, M&I water supply, and hydropower generation revenue. Water supply reliability under each Study alternative is factored into that alternative's benefits calculation. Benefits reported are annual, estimated over 50 years at the current Federal discount rate of 4 percent. For additional information, see appendixes D8, G1, and G2.
- ⁶ The benefits of improved safety have not been quantified for this Study, but would need to be more fully evaluated for a feasibility study or for cost-allocation purposes.
- ⁷ Spills are not considered a Project delivery, but are included in the calculation of benefits to wetlands.
- ⁸ The City of Fernley's municipal supply relies on groundwater available through incidental recharge from the Truckee Canal. While this is not a valid Project delivery, some alternatives would have the effect of reducing the availability of this groundwater. The demand met for the City of Fernley is noted as an environmental outcome. For additional information on how the Study evaluated the effects of Study alternatives on Fernley's ability to meet future demand, see Appendix B4.
- ⁹ Assessment of financial conditions was not conducted for the Desired Reliability scenario, because this scenario was developed to estimate a historical water supply reliability under current regulations and does not represent a current or future ability to pay.
- ¹⁰ Effects of alternatives on Carson Division groundwater and agricultural drain flows are not quantifiable, and are described in comparison to current conditions.
- ¹¹ The 150 cfs flow stage is believed to pose a lower risk to the Fernley area because the water elevation in the canal would be maintained at a level low enough to minimize the risk of destabilizing the canal embankment. However, this is not a solution specifically designed to reduce risk of operating the canal, and thus the degree to which it meets the safety objective (RR3) is unknown.
- ¹² Ability to pay estimates represents potential maximum increases to charges that TCID could apply to their customers while maintaining farm profitability, and are not reasonable to use as the sole basis for capital investment decisions. Ability to pay has been estimated using Reclamation guidelines and relies substantially upon the 5-year average for crop prices, which are volatile and presently on the higher end of historical ranges. For example, if alfalfa prices fell from current levels (\$155/ton) to levels experienced a decade ago (\$125/ton), TCID ability to pay could be reduced by as much as \$8.7 million per year. The estimated current ability of TCID to pay for projects and improvements beyond current obligations is \$6.50 million per year. (See Appendix G.)
- ¹³ Because the Desired Reliability scenario is based upon current demands, which are larger than the future demands used for Study alternatives, the flow to Pyramid Lake will automatically be somewhat higher for the alternatives than for the Desired Reliability scenario.

Key:

Avg. = average

cfs = cubic feet per second

M&I = municipal and industrial

NA = not applicable

RR = risk rating

TAF = thousand acre-feet

TCID = Truckee Canal Irrigation District

Alternative 350.a

Components and Features

Safety

HDPE Cutoff Wall Plus Other Structural Improvements Actions included to provide for safe operations of the Truckee Canal under this alternative are identical to the actions described for Alternative 600, and include the HDPE cutoff wall installed along approximately 17 miles of the canal embankment; replacement of turnout pipes, stockwater lines, and check structures; installation of check structures, wasteway turnout structures, and cross-drainages; increases in canal bank height; and removal of up to 115 trees.

Water Supply

Additional actions may not be necessary to ensure Project demand will be met and water rights will be served at the Desired Reliability level into the future.

Cost Estimates

The total annual cost for Alternative 350.a is \$2.9 million.¹ Table 5-4 identifies estimates for non-contract costs; and total construction, capital, and annualized costs.

¹ This cost does not reflect a potential reduction that may result from TCID's 2012 activities to replace turnout structures on the Truckee Canal. Replacement of these structures likely satisfies a portion of the actions to achieve the safety objective and could reduce the field cost by \$1.7 million, which is not reflected here.

Table 5-4. Alternative 350.a Cost Summary

| Measure Selected for Meeting the Safety Objective | Additional Measure(s) Selected for Meeting the Water Supply Objective | Estimated Cost (\$ Million) |
|--|--|------------------------------------|
| HDPE Cutoff Wall | | \$44.0 |
| | no additional measures selected | - |
| TOTAL FIELD COST | | \$44.0 |
| Non-Contract Costs | | |
| Planning and Environmental Compliance ¹ | | \$4.40 |
| Engineering and Design ² | | \$4.40 |
| Construction Management ³ | | \$4.40 |
| Easements ⁴ | | \$0.45 |
| Cultural Resources ⁵ | | \$1.35 |
| TOTAL CONSTRUCTION COST | | \$59.0 |
| Interest During Construction ⁶ | | \$2.00 |
| TOTAL CAPITAL COST | | \$61.0 |
| Interest and Amortization ⁷ | | \$2.80 |
| Annual Operations and Maintenance ⁸ | | \$0.10 |
| TOTAL ANNUAL COST | | \$2.90 |

Note:

Cost estimate is appraisal-level and subject to change in the future. Appraisal-level cost estimates are not suitable for requesting project authorization and/or construction fund appropriations. Cost estimate is presented in January 2012 dollars, and may have discrepancies due to rounding.

¹ 10 percent of the field cost was estimated for Planning and Environmental Compliance non-contract costs.

² 10 percent of the field cost was estimated for Engineering and Design non-contract costs.

³ 10 percent of the field cost was estimated for Construction Management non-contract costs.

⁴ 1 percent of the field cost was estimated for Easements non-contract costs.

⁵ 3 percent of the field cost was estimated for Cultural Resources non-contract costs.

⁶ Interest During Construction was estimated over 2 years of construction at the current Federal discount rate of 4 percent.

⁷ Interest and Amortization of the capital cost was estimated over 50 years at the current Federal discount rate of 4 percent.

⁸ Annual Operations and Maintenance costs were estimated at 0.2 percent of the field cost.

Key:

\$ million = million dollars

HDPE = high-density polyethylene

Accomplishments

Safety

Alternative 350.a and all other alternatives formulated and selected by the Study meet the RR3 level of risk reduction required to achieve the Study's safety objective.

Water Supply

Alternative 350.a meets or exceeds both of the conditions needed to achieve the Study's water supply objective: (1) the long-term average delivery of Project water (95.6 percent) exceeds that of the Desired Reliability scenario (94.6 percent); and (2) as shown in Figure 5-6, the largest annual difference in supply relative to the Desired Reliability scenario is approximately negative-8,000 acre-feet, which is below the desired negative-10,000 acre-foot threshold.

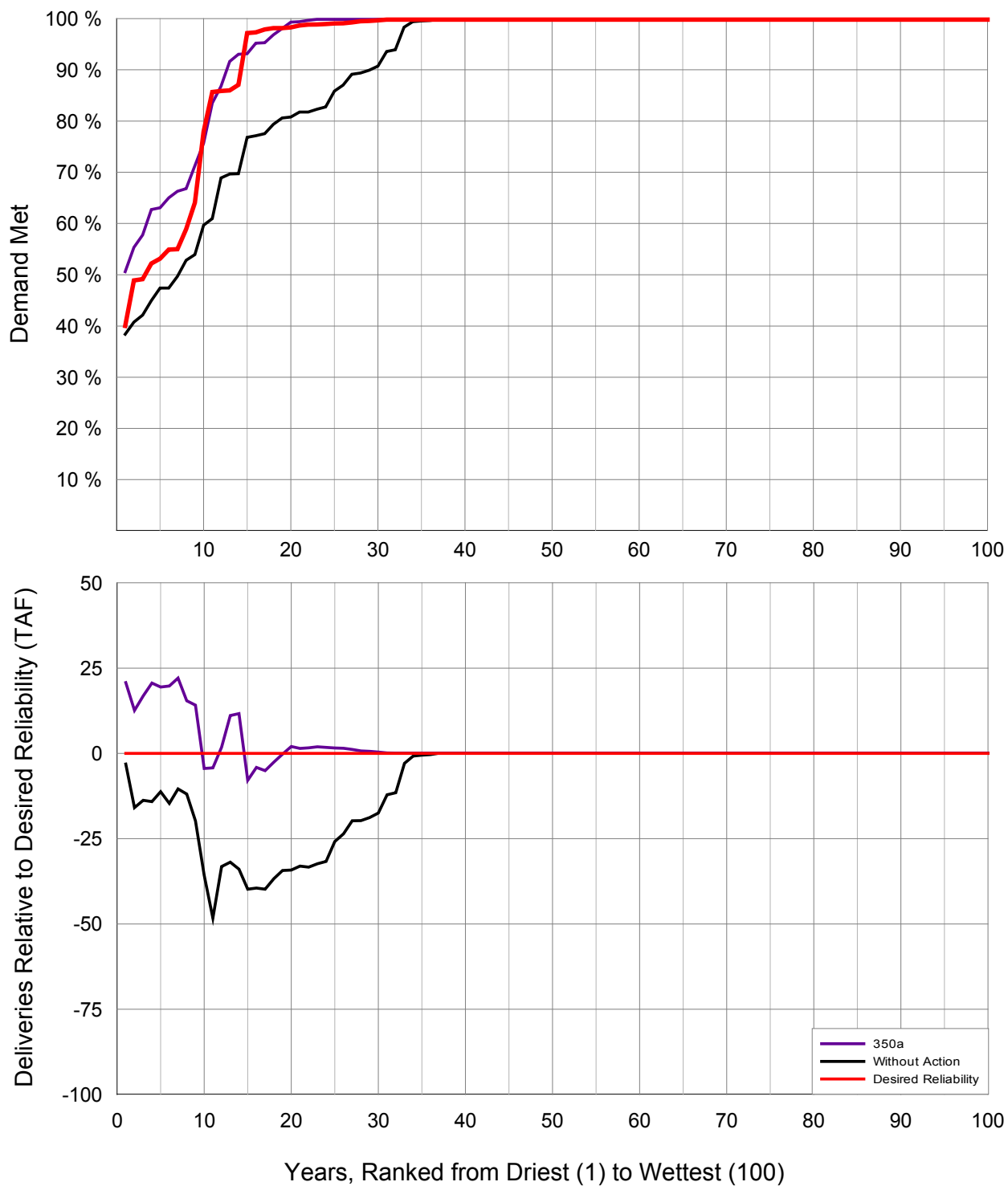


Figure 5-6. Water Supply Performance of Alternative 350.a

Project Efficiency

Alternative 350.a plans for a Project efficiency of 65 percent, and includes no actions to increase efficiency.

Seepage losses from the Truckee Canal are not reduced under this alternative.

Water Quantity and Quality on Lower Truckee River

The average annual volume of water in the lower Truckee River does not differ greatly between the Desired Reliability condition and Alternative 350.a.

- **Relative to the Desired Reliability** – Increase in Truckee River flow of 17,000 acre-feet annually.
- **Relative to the Without-Action Alternative condition** – Decrease in Truckee River flow of 29,000 acre-feet annually.

Hydropower Generation

Hydropower generation is increased under Alternative 350.a relative to the Without-Action Alternative. Average generation at Lahontan Powerplant and 26-Foot Drop powerplant is 15,650 MWh and 4,859 MWh annually, respectively.

Preliminary Alternative Review

Environmental outcomes and regulatory requirements would be very similar to those under the 600 cfs alternative, when compared to the Without-Action Alternative. The canal would be operated at a greater level than under the Without-Action Alternative, but at a lower level than under Alternative 600. Therefore, compared to the Without-Action Alternative, Lahontan Reservoir inflows and Carson River flows would increase, and Truckee River flows and Pyramid Lake inflows would decrease, but to a lesser extent than under Alternative 600. Construction activities related to safety measures would be identical to those under the 600 cfs alternative.

Environmental Outcomes

Alternative 350.a's outcomes for species and habitat in the study areas would be similar to those for Alternative 600, when compared to the Without-Action Alternative: species that use the Lahontan Reservoir and Carson Lake would experience increases in water quality and quantity; wetland and riparian areas adjacent to the Lahontan Reservoir and Carson Lake may increase in extent; species in the Truckee River and Pyramid Lake would experience decreases in water quantity and quality; and wetlands and riparian resources in the vicinity of the Truckee River and Pyramid Lake may decrease in extent (Reclamation 2000).

Deliveries to Lahontan Reservoir and the Carson Division would increase as compared to the Without-Action Alternative. This increased water availability and return flows from agricultural users would benefit Stillwater NWR, similar

to under Alternative 600, when compared to the Without-action alternative. No substantial changes in land use or land cover are anticipated to occur under this scenario; therefore, no substantial changes in air quality from agricultural activities or changes in the extent of fallow land are expected to occur.

Outcomes for the City of Fernley's municipal supply, which relies on seepage from the Truckee Canal to replenish the local groundwater aquifer, would be similar to those of Alternative 600 when compared to the Without-Action Alternative; studies have estimated that a minimum flow of 350 cfs is needed in the Truckee Canal to recharge the aquifer that served as the city's municipal water use, although this is not a valid Project delivery (City of Fernley 2012). Appendix B4 contains correspondence between Reclamation and the City of Fernley regarding Fernley's reliance on seepage from the Truckee Canal.

Construction effects from the Truckee Canal safety improvements would be identical to those noted for Alternative 600: construction activities could affect water quality and there is potential for construction noise to disturb nearby residents in some places.

Regulatory Review

A list of Federal, State, and local regulations that may be applicable is summarized in Table 5-1.

Federal Requirements Federal requirements for permitting and consultation are identical to those for Alternative 600: consultation with the USACE and USFWS would take place to identify permitting requirements; consultation with the Pyramid Lake Paiute and Fallon Paiute Shoshone tribes would be required related to Indian Trust Assets; and consultation with the Nevada SHPO would be required to assess any potential negative effects on NRHP-listed project features. NEPA compliance would be necessary, but potential project effects may be able to be adequately addressed with an EA.

State and Local Requirements State and local requirements for consultation and permitting are identical to those for Alternative 600, potentially including a Surface Area Disturbance Permit from NDEP, Bureau of Air Pollution; Construction Stormwater and Working in Waterways permits from NDEP, Bureau of Water Pollution Control; and encroachment permits from Lyon, Storey, or Churchill counties.

Economics

TCID Ability to Pay

Under Alternative 350.a, TCID's ability to pay is estimated at \$6.90 million annually. This is an improvement over the Without-Action Alternative of about \$1.90 million.

Preliminary Benefits

All preliminary benefits for Alternative 350.a are estimated in relation to conditions under the Without-Action Alternative. Although not quantified in the Study, safety to the City of Fernley is a primary benefit of Alternative 350.a. Benefits to agricultural, wetlands and M&I water supplies factor in the average water supply reliability of 95.6 percent that occurs under Alternative 350.a. Average annual revenue from hydropower generation increases \$0.14 million over the Without-Action Alternative. The annual benefit of increased agricultural water supply for the Project is estimated at \$1.00 million. The annual benefit of increased supply to wetlands is \$0.41 million. The annual benefit of increased M&I supply is estimated at \$0.01 million.

Implementation Considerations

Compatibility with Applicable Laws, Policies, and Plans

Alternative 350.a is anticipated to be compatible with all existing laws and policies. It is also compatible with recent Truckee Canal rehabilitation actions taken by TCID to remove the 33 existing conduits to the laterals and replace them with 17 structures that include both lateral and stock line delivery features (TCID 2012b).

The range of environmental outcomes is more limited under this alternative than other alternatives evaluated, and may be able to be evaluated in an EA (see the “Preliminary Alternative Review” subsection above).

Federal and Non-Federal Roles and Responsibilities

Reclamation would likely be the Federal lead for permitting and NEPA compliance. As the local contractor, TCID would likely obtain State and local permits related to construction activities.

Potential for Cost-Sharing

TCID TCID should be considered a potential cost-share partner because Alternative 350.a significantly increases the water supply reliability experienced by its customers, which in turn improves its hydropower generation capacity—one of the largest sources of annual revenue for the district.

City of Fernley The City of Fernley should be considered as a potential cost-share partner for this Study alternative. The benefit of life safety and averted flood damage reduction would serve as a portion of the benefit that the city derives from Alternative 350.a. Additionally, Fernley receives the incidental benefit of continued seepage from the Truckee Canal into the local aquifer. By implementing this alternative, instead of another alternative that lines the Truckee Canal and reduces seepage, the city avoids the cost of replacing the groundwater supplies that they rely on.

Summary of Alternative 350.a

Table 5-5 below summarizes the performance, accomplishments, benefits, costs, and other characteristics of Alternative 350.a.

Table 5-5. Characteristics of Alternative 350.a

| | | Alternative 350.a | Without-Action Alternative | Desired Reliability Scenario |
|--|--|------------------------------------|---|-------------------------------------|
| Major Features | Truckee Canal Flow Stage | 350 cfs | 150 cfs | 900 cfs |
| | Truckee Canal HDPE Cutoff Wall or Lining | HDPE Cutoff Wall | - | NA |
| | Other Features | - | - | NA |
| Safety | | Meets RR3 | Uncertain ¹¹ | NA |
| Average Annual Project Water Delivery¹ (percent) | | 95.6% | 90.5% | 94.6% |
| Average Annual Project Delivery by User Category | Ag/Irrigation (TAF) | 117.2 | 111.2 | NA |
| | Deliveries to M&I (TAF) | 13.3 | 13.2 | NA |
| | Lahontan Valley Wetlands ² (TAF) | 67.3 | 63.6 | NA |
| Annual Cost³ (millions) | | \$2.90 | NA | NA |
| TCID Ability-to-Pay¹² (millions) | | \$6.90 | \$5.00 | NA ⁹ |
| Preliminary Benefits⁵ (annual) | Agricultural Water Supply Reliability (millions) | \$1.00 | NA | NA |
| | Wetlands/ Environmental Water Supply Reliability ⁴ (millions) | \$0.41 | NA | NA |
| | M&I Water Supply Reliability (millions) | \$0.01 | NA | NA |
| | Hydropower Generation Revenue (millions) | \$0.14 | NA | NA |
| | Safety ⁶ | Increased | NA | NA |
| Environmental and Other Effects | Avg. Annual Spill to Stillwater NWR from Lahontan Dam (TAF) ⁷ | 12.1 | 11.0 | 12.5 |
| | Carson Division Groundwater and Agricultural Drain Flows ¹⁰ | Significant change not anticipated | Reduced in comparison to current conditions | Similar to current conditions |
| | City of Fernley Demand Met ⁸ (percent) | 108% | 99% | 121% |
| | Avg. Annual Flow to Pyramid Lake (TAF) | 487 | 516 | 460 ¹³ |

Table 5-5. Characteristics of Alternative 350.a (contd.)

Notes:

- ¹ Long-term average annual percent of Newlands Project demand met.
- ² Includes deliveries to Carson Lake and Pasture, the Fallon Paiute-Shoshone Tribal wetlands, and Stillwater NWR.
- ³ Annual costs include interest and amortization of the capital cost estimated over 50 years at the current federal discount rate of 4 percent. Costs also include annual operations and maintenance estimated at 0.2 percent of the field cost. For some alternatives with the Dry-Year Fallowing, annual costs for the program were estimated at \$100 per acre of land fallowing plus an administrative cost at 20 percent of the fee. For additional information, see Appendix E3.
- ⁴ Based on volume of deliveries to Carson Lake and Pasture, the Fallon Paiute-Shoshone Tribal wetlands, and Stillwater NWR, and also spills to Stillwater from Lahontan Dam. Excludes consideration of water supply from return flows and groundwater.
- ⁵ Preliminary benefits were estimated as the change between a Study alternative and the Without-Action Alternative for agricultural water supply, wetlands water supply, M&I water supply, and hydropower generation revenue. Water supply reliability under each Study alternative is factored into that alternative's benefits calculation. Benefits reported are annual, estimated over 50 years at the current Federal discount rate of 4 percent. For additional information, see appendixes D8, G1, and G2.
- ⁶ The benefits of improved safety have not been quantified for this Study, but would need to be more fully evaluated for a feasibility study or for cost-allocation purposes.
- ⁷ Spills are not considered a Project delivery, but are included in the calculation of benefits to wetlands.
- ⁸ The City of Fernley's municipal supply relies on groundwater available through incidental recharge from the Truckee Canal. While this is not a valid Project delivery, some alternatives would have the effect of reducing the availability of this groundwater. The demand met for the City of Fernley is noted as an environmental outcome. For additional information on how the Study evaluated the effects of Study alternatives on Fernley's ability to meet future demand, see Appendix B4.
- ⁹ Assessment of financial conditions was not conducted for the Desired Reliability scenario, because this scenario was developed to estimate a historical water supply reliability under current regulations and does not represent a current or future ability to pay.
- ¹⁰ Effects of alternatives on Carson Division groundwater and agricultural drain flows are not quantifiable, and are described in comparison to current conditions.
- ¹¹ The 150 cfs flow stage is believed to pose a lower risk to the Fernley area because the water elevation in the canal would be maintained at a level low enough to minimize the risk of destabilizing the canal embankment. However, this is not a solution specifically designed to reduce risk of operating the canal, and thus the degree to which it meets the safety objective (RR3) is unknown.
- ¹² Ability to pay estimates represents potential maximum increases to charges that TCID could apply to their customers while maintaining farm profitability, and are not reasonable to use as the sole basis for capital investment decisions. Ability to pay has been estimated using Reclamation guidelines and relies substantially upon the 5-year average for crop prices, which are volatile and presently on the higher end of historical ranges. For example, if alfalfa prices fell from current levels (\$155/ton) to levels experienced a decade ago (\$125/ton), TCID ability to pay could be reduced by as much as \$8.7 million per year. The estimated current ability of TCID to pay for projects and improvements beyond current obligations is \$6.50 million per year. (See Appendix G.)
- ¹³ Because the Desired Reliability scenario is based upon current demands, which are larger than the future demands used for Study alternatives, the flow to Pyramid Lake will automatically be somewhat higher for the alternatives than for the Desired Reliability scenario.

Key:

Avg. = average
cfs = cubic feet per second
M&I = municipal and industrial
NWR = National Wildlife Refuge
RR = risk rating
TAF = thousand acre-feet
TCID = Truckee Canal Irrigation District

Alternative 350.b

Components and Features

Safety

HDPE Cutoff Wall Plus Other Structural Improvements Actions included to provide for safe operations of the Truckee Canal under this alternative are identical to the actions described for alternatives 600 and 350.a, and include the HDPE cutoff wall installed along approximately 17 miles of the canal embankment; replacement of turnout pipes, stockwater lines, and check structures; installation of check structures, wasteway turnout structures, and cross-drainages; increases in canal bank height; and removal of up to 115 trees.

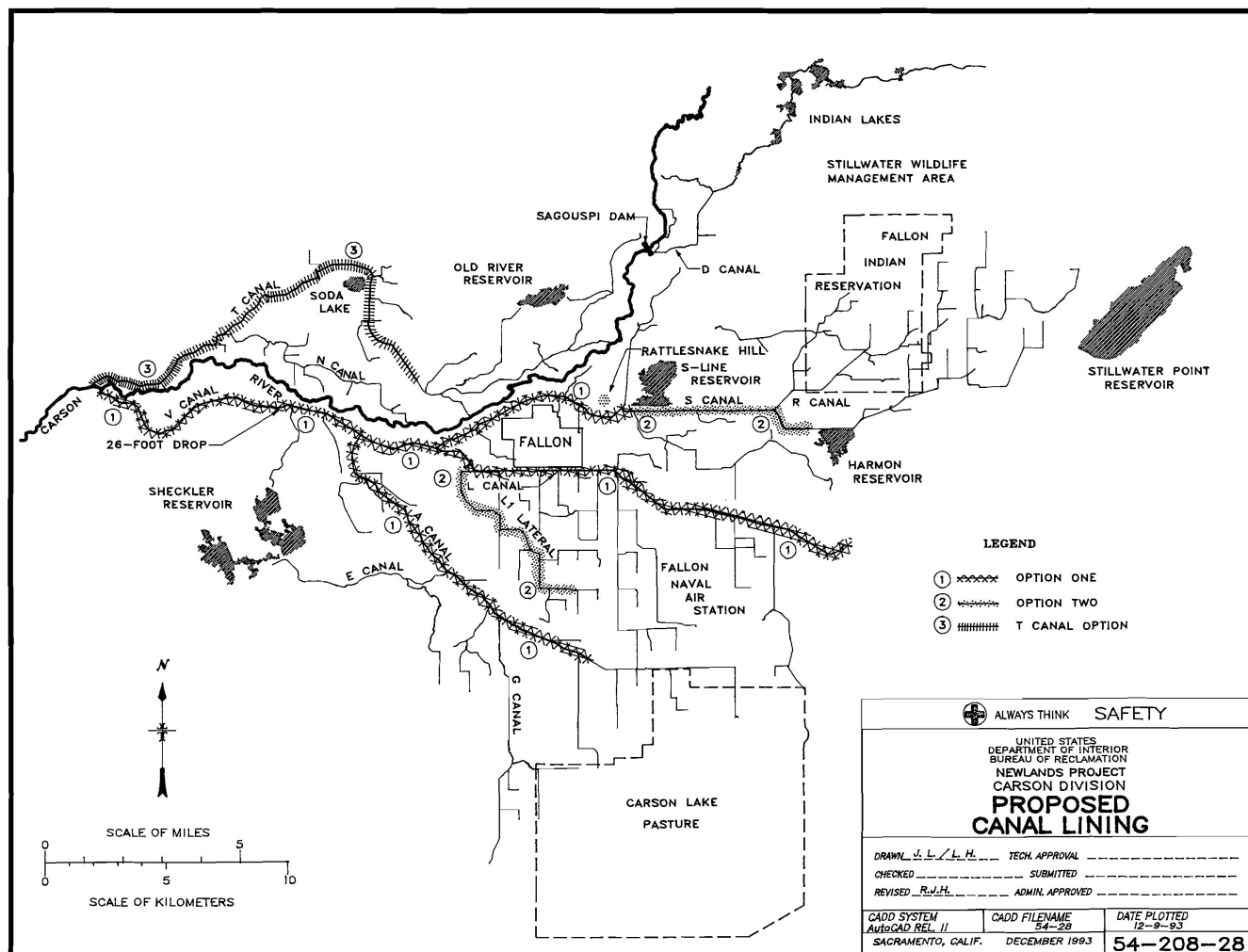
Water Supply

Line Carson Division's Main Canals and Laterals Line 44.9 miles of conveyance facilities in the Carson Division with a 4-inch concrete geomembrane liner, consistent with the "Option 1 Expanded" recommendation in the *Newlands Project Efficiency Study* (Reclamation 1994). This includes portions of the V, S, L, and A canals, and part of the L1 Lateral—facilities in which conveyance losses due to seepage are greatest, based on conclusions of the Efficiency Study.

Areas to be lined include:

- V Canal from its head works to 26-Foot Drop (first 5.9 miles)
- V Canal from 26-Foot drop to terminus, and S Canal from V Canal terminus to S-line Reservoir (9.33 miles)
- L Canal from its headworks at V Canal to its terminus at the sixth and final check structure (first 9.37 miles)
- A Canal from its headworks to the A17 Lateral headworks (first 9.7 miles)
- S Canal between S-line Reservoir and Harmon Reservoir (5.07 miles)
- Unlined portion of L1 Lateral from the headworks to the L1-10 Lateral (5.5 miles of the first 6 miles)

The extent lining is shown as "Option 1" and "Option 2," in combination, on Figure 5-7 below from the Efficiency Study.



Source: Reclamation 1994

Figure 5-7. Carson Division Canal Lining Options

Cost Estimates

The total annual cost for Alternative 350.b is \$15 million.¹ The following table identifies estimates for non-contract costs; and total construction, capital, and annualized costs.

¹ This cost does not reflect a potential reduction that may result from TCID's 2012 activities to replace turnout structures on the Truckee Canal. Replacement of these structures likely satisfies a portion of the actions to achieve the safety objective and could reduce the field cost by \$1.7 million, which is not reflected here.

Table 5-6. Alternative 350.b Cost Summary

| Measure Selected for Meeting the Safety Objective | Additional Measure(s) Selected for Meeting the Water Supply Objective | Estimated Cost (\$ Million) |
|--|--|------------------------------------|
| HDPE Cutoff Wall | | \$44.0 |
| | Line Main Canals and Laterals | \$165.0 |
| TOTAL FIELD COST | | \$210.0 |
| Non-Contract Costs | | |
| Planning and Environmental Compliance ¹ | | \$10.0 |
| Engineering and Design ² | | \$21.0 |
| Construction Management ³ | | \$21.0 |
| Easements ⁴ | | \$2.00 |
| Cultural Resources ⁵ | | \$6.00 |
| TOTAL CONSTRUCTION COST | | \$270.0 |
| Interest During Construction ⁶ | | \$50.0 |
| TOTAL CAPITAL COST | | \$320.0 |
| Interest and Amortization ⁷ | | \$14.5 |
| Annual Operations and Maintenance ⁸ | | \$0.50 |
| TOTAL ANNUAL COST | | \$15.0 |

Note:

Cost estimate is appraisal-level and subject to change in the future. Appraisal-level cost estimates are not suitable for requesting project authorization and/or construction fund appropriations. Cost estimate is presented in January 2012 dollars, and may have discrepancies due to rounding.

¹ 5 percent of the field cost was estimated for Planning and Environmental Compliance non-contract costs.

² 10 percent of the field cost was estimated for Engineering and Design non-contract costs.

³ 10 percent of the field cost was estimated for Construction Management non-contract costs.

⁴ 1 percent of the field cost was estimated for Easements non-contract costs.

⁵ 3 percent of the field cost was estimated for Cultural Resources non-contract costs.

⁶ Interest During Construction was estimated over 8 years of construction at the current Federal discount rate of 4 percent.

⁷ Interest and Amortization of the capital cost was estimated over 50 years at the current Federal discount rate of 4 percent.

⁸ Annual Operations and Maintenance costs were estimated at 0.2 percent of the field cost.

Key:

\$ million = million dollars

HDPE = high-density polyethylene

Accomplishments

Safety

Alternative 350.b and all other alternatives formulated and selected by the Study meet the RR3 level of risk reduction required to achieve the Study's safety objective.

Water Supply

Alternative 350.b meets or exceeds both of the conditions needed to achieve the Study's water supply objective: (1) the long-term average delivery of Project water (97.3 percent) exceeds that of the Desired Reliability scenario (94.6 percent); and (2) as shown in Figure 5-8, deliveries for Alternative 350.b exceed those for the Desired Reliability for each of the 100 years evaluated.

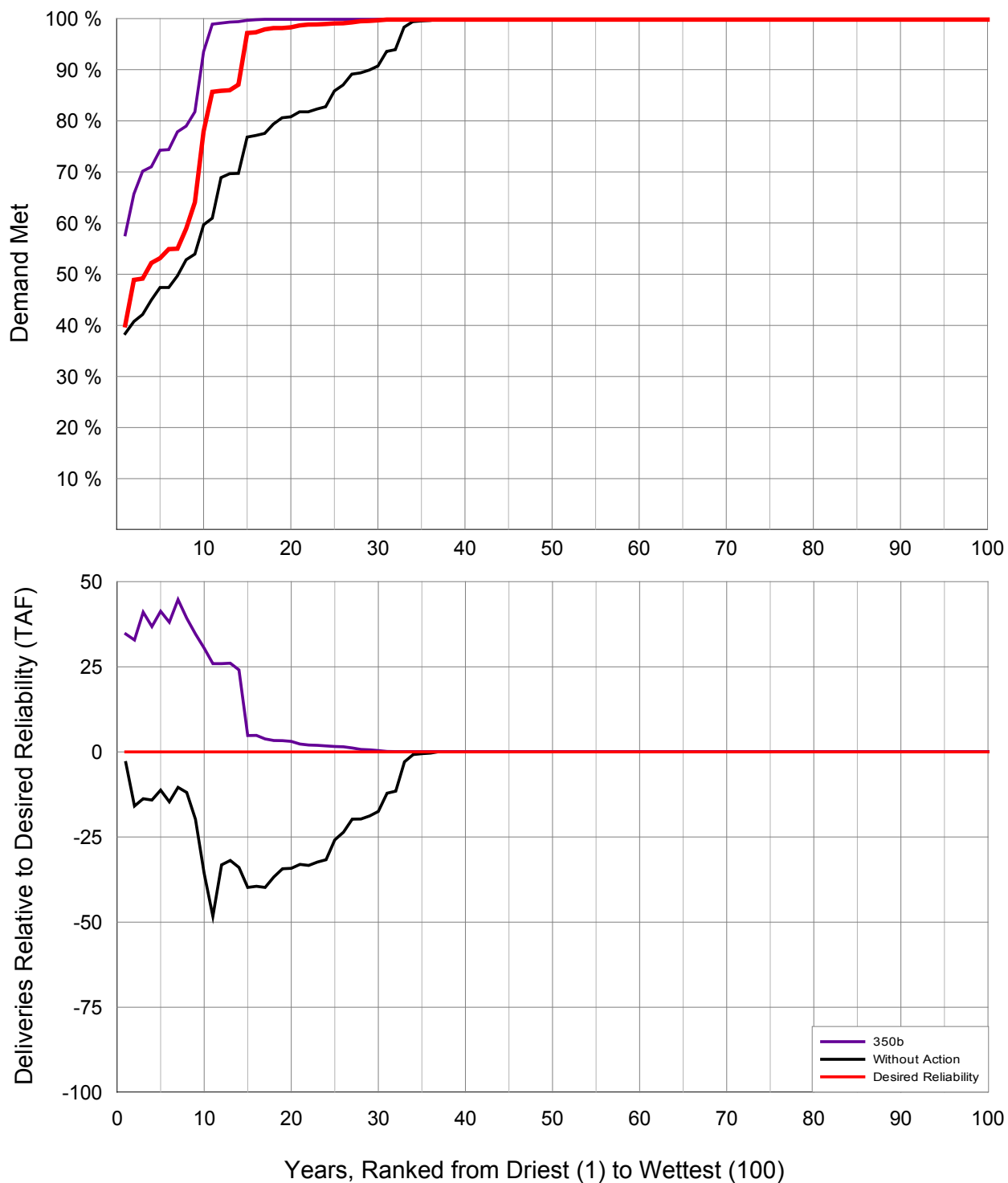


Figure 5-8. Water Supply Performance of Alternative 350.b

Project Efficiency

Alternative 350.b plans for increasing Project efficiency to 75 percent, with the associated increases in water supply being dedicated to Project water users.

Seepage losses from the Truckee Canal are not reduced under this alternative.

Water Quantity and Quality on Lower Truckee River

The average annual volume of water in the lower Truckee River for Alternative 350.b is greater than that of the Desired Reliability condition but less than that of the Without-Action Alternative.

- **Relative to the Desired Reliability** – Increase in Truckee River flow of 35,000 acre-feet annually.
- **Relative to the Without-Action Alternative condition** – Decrease in Truckee River flow of 11,000 acre-feet annually.

Hydropower Generation

Hydropower generation is increased under Alternative 350.b relative to the Without-Action Alternative. Average generation at Lahontan Powerplant and 26-Foot Drop powerplant is 15,179 MWh and 4,331 MWh annually, respectively.

Preliminary Alternative Review

Environmental outcomes and regulatory requirements would be somewhat similar to those under Alternative 350.a, when compared to the Without-Action Alternative. Alternative 350.b would have an overall lower level of water diversion than 350.a. Alternative 350.b would have same construction effects as alternatives 600 cfs and 350.a, with the addition of effects from lining of canals in the Carson Division. There would be direct effects from construction activities in the canals and indirect effects related to potential reductions in groundwater levels throughout the Carson Division.

Environmental Outcomes

Alternative 350.b's outcomes for species and habitat in the study areas would be similar to those for alternatives 600 and 350.a, when compared to the Without-Action Alternative: species that use the Lahontan Reservoir and Carson Lake would experience increases in water quality and quantity; wetland and riparian areas adjacent to the Lahontan Reservoir and Carson Lake may increase in extent; species in the Truckee River and Pyramid Lake would experience decreases in water quantity and quality; and wetlands and riparian resources in the vicinity of the Truckee River and Pyramid Lake may decrease in extent (Reclamation 2000).

Deliveries to Lahontan Reservoir and the Carson Division would increase as compared to the Without-Action Alternative. Increased water availability within the Carson Division and return flows from agricultural users would benefit

Stillwater NWR, similar to under alternatives 600 and 350.a, when compared to the Without-action alternative.

This could be offset, however, by a reduction in seepage noted above from the main canals and laterals in the Carson Division, which could affect the reliability of local groundwater supplies for the City of Fallon, Churchill County, and NAS Fallon (Brad Goetsch and Eleanor Lockwood, Churchill County, personal communication, August 25, 2011). No permanent changes in land use or land cover are anticipated to occur under this scenario; therefore, no substantial changes in air quality from agricultural activities or changes in the extent of fallow land are expected to occur.

Additionally, it is possible that with a reduction in groundwater, some Project landowners may seek to have their land reclassified from bottom land to bench land (public comments, August 2011). A large portion of the Carson Division has been classified as bottom land due to the shallow depths to groundwater, which is supported by land application in the Project and by seepage losses during conveyance. The duty for bottom lands is set at 3.5 acre-feet per acre, with the assumption that a portion of crop demands is met from groundwater within the root-zone. If groundwater levels recede, portions of the Carson Division may need to be reclassified as bench lands, with a corresponding increase in duty for those lands to 4.5 acre-feet per acre. Rights would need to be reclassified individually, with review and approval from the Nevada State Engineer and/or Federal Watermaster. However, this Study has noted that even if a large proportion of Project lands were to be reclassified, the overall effect on Project demand would be an increase of about 2 percent (see Appendix D4).

Outcomes for the City of Fernley's municipal supply, which relies on seepage from the Truckee Canal to replenish the local groundwater aquifer, would be similar to those of alternatives 600 and 350.a when compared to the Without-Action Alternative; studies have estimated that a minimum flow of 350 cfs is needed in the Truckee Canal to recharge the aquifer that served as the city's municipal water use, although this is not a valid Project delivery (City of Fernley 2012). Appendix B4 contains correspondence between Reclamation and the City of Fernley regarding Fernley's reliance on seepage from the Truckee Canal.

Construction effects from the Truckee Canal safety improvements would be identical to those noted for alternatives 600 and 350.a: construction activities could affect water quality and there is potential for construction noise to disturb nearby residents in some places. Construction activities associated with canal lining in the Carson Division would result in similar effects to those related to the Truckee Canal, but in a larger geographic area; therefore, construction effects would be similar to those under alternatives 600 cfs and 350.a, but more extensive.

Regulatory Review

A list of Federal, State, and local regulations that may be applicable is summarized in Table 5-1.

Federal Requirements Federal requirements for permitting and consultation are similar to those for alternatives 600 and 350.a: consultation with the USACE and USFWS would take place to identify permitting requirements; consultation with the Pyramid Lake Paiute and Fallon Paiute Shoshone tribes would be required related to Indian Trust Assets; and consultation with the Nevada SHPO would be required to assess any potential negative effects on NRHP-listed project features. However, because of the range and complexity of potential environmental outcomes of Alternative 350.b, an EIS – rather than an EA – may be required to sufficiently evaluate effects.

State and Local Requirements State and local requirements for consultation and permitting are likely identical to those for alternatives 600 and 350.a, potentially including: a Surface Area Disturbance Permit from NDEP, Bureau of Air Pollution; Construction Stormwater and Working in Waterways permits from NDEP, Bureau of Water Pollution Control; and encroachment permits from Lyon, Storey, or Churchill counties.

Economics

TCID Ability to Pay

Under Alternative 350.b, TCID's ability to pay is estimated at \$7.40 million annually. This is an improvement over the Without-Action Alternative of about \$2.40 million.

Preliminary Benefits

All preliminary benefits for Alternative 350.b are estimated in relation to conditions under the Without-Action Alternative. Although not quantified in the Study, safety to the City of Fernley is a primary benefit of Alternative 350.b. Benefits to agricultural, wetlands and M&I water supplies factor in the average water supply reliability of 97.3 percent that occurs under Alternative 350.b. Average annual revenue from hydropower generation increases \$0.08 million over the Without-Action Alternative. The annual benefit of increased agricultural water supply for the Project is estimated at \$1.35 million. The annual benefit of increased supply to wetlands is \$0.70 million. The annual benefit of increased M&I supply is estimated at \$0.02 million.

Implementation Considerations

Compatibility with Applicable Laws, Policies, and Plans

Alternative 350.b is anticipated to be compatible with all existing laws and policies. It is also compatible with recent Truckee Canal rehabilitation actions taken by TCID to remove the 33 existing conduits to the laterals and replace

them with 17 structures that include both lateral and stock line delivery features (TCID 2012b).

It is possible that the actions in alternative 350.b may require a more extensive NEPA evaluation before implementation (see the “Preliminary Alternative Review” subsection above), such as an EIS rather than an EA.

Federal and Non-Federal Roles and Responsibilities

Reclamation would likely be the Federal lead for permitting and NEPA compliance. As the local contractor, TCID would likely obtain State and local permits related to construction activities.

Potential for Cost-Sharing

TCID TCID should be considered a potential cost-share partner because Alternative 350.b significantly increases the water supply reliability experienced by its customers, which in turn improves its hydropower generation capacity – one of the largest sources of annual revenue for the district.

City of Fernley The City of Fernley should be considered as a potential cost-share partner for this Study alternative. The benefit of life safety and averted flood damage reduction would serve as a portion of the benefit that the city derives from Alternative 350.b. Additionally, Fernley receives the incidental benefit of continued seepage from the Truckee Canal into the local aquifer. By implementing this alternative, instead of another alternative that lines the Truckee Canal and reduces seepage, the city avoids the cost of replacing the groundwater supplies that they rely on.

Pyramid Lake Paiute Tribe The Pyramid Lake Paiute Tribe should be considered as a potential cost-share partner. Among the range of alternatives available for meeting the Study objectives, Alternative 350.b maintains the second-highest flows to Pyramid Lake.

Summary of Alternative 350.b

Table 5-7 below summarizes the performance, accomplishments, benefits, costs, and other characteristics of Alternative 350.b.

Table 5-7. Characteristics of Alternative 350.b

| | | Alternative 350.b | Without-Action Alternative | Desired Reliability Scenario |
|--|--|---|---|-------------------------------------|
| Major Features | Truckee Canal Flow Stage | 350 cfs | 150 cfs | 900 cfs |
| | Truckee Canal HDPE Cutoff Wall or Lining | HDPE Cutoff Wall | - | NA |
| | Other Features | Lining 45 miles of Carson Division canals | - | NA |
| Safety | | Meets RR3 | Uncertain ¹² | NA |
| Average Annual Project Water Delivery¹ (percent) | | 97.3% | 90.5% | 94.6% |
| Average Annual Project Delivery by User Category | Ag/Irrigation (TAF) | 119.2 | 111.2 | NA |
| | M&I (TAF) | 13.4 | 13.2 | NA |
| | Lahontan Valley Wetlands ² (TAF) | 68.6 | 63.6 | NA |
| Annual Cost³ (millions) | | \$15.00 | NA | NA |
| TCID Ability-to-Pay¹³ (millions) | | \$7.40 | \$0.72 | NA ¹⁰ |
| Preliminary Benefits⁶ (annual) | Agricultural Water Supply Reliability (millions) | \$1.35 | NA | NA |
| | Wetlands/ Environmental Water Supply Reliability ⁴ (millions) | \$0.70 ⁵ | NA | NA |
| | M&I Water Supply Reliability (millions) | \$0.02 | NA | NA |
| | Hydropower Generation Revenue (millions) | \$0.08 | NA | NA |
| | Safety ⁷ | Increased | NA | NA |
| Environmental and Other Effects | Avg. Annual Spill to Stillwater NWR from Lahontan Dam (TAF) ⁸ | 14.3 | 11.0 | 12.5 |
| | Carson Division Groundwater and Agricultural Drain Flows ¹¹ | Reduced by lining Carson Division canals | Reduced in comparison to current conditions | Similar to current conditions |
| | City of Fernley Demand Met ⁹ (percent) | 108% | 99% | 121% |
| | Avg. Annual Flow to Pyramid Lake (TAF) | 505 | 516 | 460 ¹⁴ |

Table 5-7. Characteristics of Alternative 350.b (contd.)

Notes:

- ¹ Long-term average annual percent of Newlands Project demand met.
- ² Includes deliveries to Carson Lake and Pasture, the Fallon Paiute-Shoshone Tribal wetlands, and Stillwater NWR.
- ³ Annual costs include interest and amortization of the capital cost estimated over 50 years at the current federal discount rate of 4 percent. Costs also include annual operations and maintenance estimated at 0.2 percent of the field cost. For some alternatives with the Dry-Year Fallowing, annual costs for the program were estimated at \$100 per acre of land fallowing plus an administrative cost at 20 percent of the fee. For additional information, see Appendix E3.
- ⁴ Based on volume of deliveries to Carson Lake and Pasture, the Fallon Paiute-Shoshone Tribal wetlands, and Stillwater NWR, and also spills to Stillwater from Lahontan Dam. Excludes consideration of water supply from return flows and groundwater.
- ⁵ May be lower due to reductions in other supply sources resulting from implementation of Study alternatives, but which could not be quantified.
- ⁶ Preliminary benefits were estimated as the change between a Study alternative and the Without-Action Alternative for agricultural water supply, wetlands water supply, M&I water supply, and hydropower generation revenue. Water supply reliability under each Study alternative is factored into that alternative's benefits calculation. Benefits reported are annual, estimated over 50 years at the current Federal discount rate of 4 percent. For additional information, see appendixes D8, G1, and G2.
- ⁷ The benefits of improved safety have not been quantified for this Study, but would need to be more fully evaluated for a feasibility study or for cost-allocation purposes.
- ⁸ Spills are not considered a Project delivery, but are included in the calculation of benefits to wetlands.
- ⁹ The City of Fernley's municipal supply relies on groundwater available through incidental recharge from the Truckee Canal. While this is not a valid Project delivery, some alternatives would have the effect of reducing the availability of this groundwater. The demand met for the City of Fernley is noted as an environmental outcome. For additional information on how the Study evaluated the effects of Study alternatives on Fernley's ability to meet future demand, see Appendix B4.
- ¹⁰ Assessment of financial conditions was not conducted for the Desired Reliability scenario, because this scenario was developed to estimate a historical water supply reliability under current regulations and does not represent a current or future ability to pay.
- ¹¹ Effects of alternatives on Carson Division groundwater and agricultural drain flows are not quantifiable, and are described in comparison to current conditions.
- ¹² The 150 cfs flow stage is believed to pose a lower risk to the Fernley area because the water elevation in the canal would be maintained at a level low enough to minimize the risk of destabilizing the canal embankment. However, this is not a solution specifically designed to reduce risk of operating the canal, and thus the degree to which it meets the safety objective (RR3) is unknown.
- ¹³ Ability to pay estimates represents potential maximum increases to charges that TCID could apply to their customers while maintaining farm profitability, and are not reasonable to use as the sole basis for capital investment decisions. Ability to pay has been estimated using Reclamation guidelines and relies substantially upon the 5-year average for crop prices, which are volatile and presently on the higher end of historical ranges. For example, if alfalfa prices fell from current levels (\$155/ton) to levels experienced a decade ago (\$125/ton), TCID ability to pay could be reduced by as much as \$8.7 million per year. The estimated current ability of TCID to pay for projects and improvements beyond current obligations is \$6.50 million per year. (See Appendix G.)
- ¹⁴ Because the Desired Reliability scenario is based upon current demands, which are larger than the future demands used for Study alternatives, the flow to Pyramid Lake will automatically be somewhat higher for the alternatives than for the Desired Reliability scenario.

Key:

Avg. = average

M&I = municipal and industrial

RR = risk rating

TAF = thousand acre-feet

TCID = Truckee Canal Irrigation District

Alternative 350.d

Components and Features

Safety

Concrete Geomembrane Lining The primary action to achieve safety is to line the Truckee Canal in the following portions of the structure:

- 1.7 miles of the Derby Reach of the canal (between STA 409+75 to 411+00, 418+00 to 425+00, 433+00 to 445+00, 469+00 to 502+00, and 525+00 to 543+10)
- The entire Fernley Reach (from STA 543+10 to 1126+40)
- 4.2 miles of the Lahontan Reach (from STA 1126+40 to 1260+00, 1270+00 to 1288+00, 1294+00 to 1300+00, and 1302+00 to 1340+00)

This option consists of constructing an unreinforced concrete lining on top of a Low-Density Polyethylene (LDPE) geomembrane. The canal section would be designed to a smaller cross-section prism than the existing channel geometry. Because of concerns with the stability of the unreinforced concrete being placed on top of the membrane, a side slope of 2 horizontal to 1 vertical (2:1) would be the maximum side slopes. The LDPE geomembrane will be textured creating additional friction between the membrane and concrete lining. The LDPE would need to be 40 thousandth of an inch (mil) thick. The unreinforced concrete lining would be 3 inches thick. The concrete lining protects the LDPE from being damaged during maintenance work, large debris flows, and animals.

The installation of a properly installed geomembrane and concrete liner would essentially eliminate seepage into the canal embankment and foundation.

Other Structural Improvements Additional actions to achieve the safety objective for this alternative:

- Replace each turnout pipe in the canal: nine in the Fernley Reach (at STA 578+66, 641+09, 668+58, 695+60, 728+50, 822+13, 848+82, 1003+54, and 1057+84) and two in the Lahontan Reach (at 1302+39 and 1465+06). The turnouts would be designed with the appropriate canal water surface elevation for delivering the required turnout flows. A new turnout structure with slide gate will be installed with the required pipe diameters designed to deliver the flow needed. A sand filter collar would be installed along a portion of the outlet side of the

pipe. Riprap protection within the canal bank on either side of the structure would prevent animals from burrowing around the structure.¹

- Replace all stock water line systems, and combine existing stock watering pipes with the new turnouts where applicable.¹
- Replace four check structures in the Fernley Reach (Fernley, Anderson, and Allendale checks) and Lahontan Reach (Mason Check) with new, automated check structures.
- Remove the abandoned Pyramid (Derby) Check.
- Install a new check structure upstream from TC-1.
- Install five cross-drainage structures in the Derby Reach (at STA 28+00, 93+00, 180+00, 266+65, and 464+50).
- Install 10 wasteway turnout structures in the Fernley Reach (STA 544+33, 589+53, 633+70, 684+00, 795+15, 850+14, 923+58, 973+70, 1050+40, and 1100+00).
- Increase the canal bank height along 1.9 miles of the Lahontan Reach (from STA 1200+00 to 1302+00).
- Remove up to 115 trees located within 15 feet of the downstream toe of the landside slope in the Fernley and Lahontan reaches.

Replacing existing canal appurtenance structures and new canal appurtenance structures provides risk reduction for several Truckee Canal failure modes (see Chapter 3). The cross-drainage structures will convey rainfall runoff across the canal and into the Truckee River in the Derby Reach. The new check structures will replace the existing checks to provide large check openings and gates to pass ice-jammed flows and flood flows. They will also allow for elevated water levels above the normal operating level to bypass the check gates by overflowing weirs on either side of the gates. The wasteway turnout structures combine an overflow weir and turnout into one structure that provides protection against overtopping of the canal, as well as normal diversion delivery flow to irrigators.

¹ These actions were identified by Reclamation in the Corrective Action Study (Reclamation 2011e) before TCID replaced the Truckee Canal's turnouts with new structures that include both stock line and delivery features. This canal conduit rehabilitation work occurred in 2012 and likely satisfies a portion of the safety objective the alternatives seek to achieve.

Water Supply

Line Truckee Canal As described for safety purposes above, line approximately 17 miles of the Truckee Canal with an impermeable geomembrane covered by unreinforced concrete.

Cost Estimates

The total annual cost for Alternative 350.d is \$4.2 million.¹ Table 5-8 identifies estimates for non-contract costs; and total construction, capital, and annualized costs.

¹ This cost does not reflect a potential reduction that may result from TCID's 2012 activities to replace turnout structures on the Truckee Canal. Replacement of these structures likely satisfies a portion of the actions to achieve the safety objective and could reduce the field cost by \$1.7 million, which is not reflected here.

Table 5-8. Alternative 350.d Cost Summary

| Measure Selected for Meeting the Safety Objective | Additional Measure(s) Selected for Meeting the Water Supply Objective | Estimated Cost (\$ Million) |
|--|---|-----------------------------|
| Concrete/ Geomembrane Lining | | \$59.0 |
| | No additional measures selected | - |
| TOTAL FIELD COST | | \$59.0 |
| Non-Contract Costs | | |
| Planning and Environmental Compliance ¹ | | \$7.00 |
| Engineering and Design ² | | \$5.80 |
| Construction Management ³ | | \$5.80 |
| Easements ⁴ | | \$0.60 |
| Cultural Resources ⁵ | | \$1.80 |
| TOTAL CONSTRUCTION COST | | \$80.0 |
| Interest During Construction ⁶ | | \$7.00 |
| TOTAL CAPITAL COST | | \$87.0 |
| Interest and Amortization ⁷ | | \$4.10 |
| Annual Operations and Maintenance ⁸ | | \$0.10 |
| TOTAL ANNUAL COST | | \$4.20 |

Note:

Cost estimate is appraisal-level and subject to change in the future. Appraisal-level cost estimates are not suitable for requesting project authorization and/or construction fund appropriations. Cost estimate is presented in January 2012 dollars, and may have discrepancies due to rounding.

¹ 12 percent of the field cost was estimated for Planning and Environmental Compliance non-contract costs.

² 10 percent of the field cost was estimated for Engineering and Design non-contract costs.

³ 10 percent of the field cost was estimated for Construction Management non-contract costs.

⁴ 1 percent of the field cost was estimated for Easements non-contract costs.

⁵ 3 percent of the field cost was estimated for Cultural Resources non-contract costs.

⁶ Interest During Construction was estimated over 4 years of construction at the current Federal discount rate of 4 percent.

⁷ Interest and Amortization of the capital cost was estimated over 50 years at the current Federal discount rate of 4 percent.

⁸ Annual Operations and Maintenance costs were estimated at 0.2 percent of the field cost.

Key:

\$ million = million dollars

HDPE = high-density polyethylene

Accomplishments

Safety

Alternative 350.d and all other alternatives formulated and selected by the Study meet the RR3 level of risk reduction required to achieve the Study's safety objective.

Water Supply

Alternative 350.d meets or exceeds both of the conditions needed to achieve the Study's water supply objective: (1) the long-term average delivery of Project water (96.3 percent) exceeds that of the Desired Reliability scenario (94.6 percent); and (2) as shown in Figure 5-9, deliveries for Alternative 350.d exceed those for the Desired Reliability for each of the 100 years evaluated.

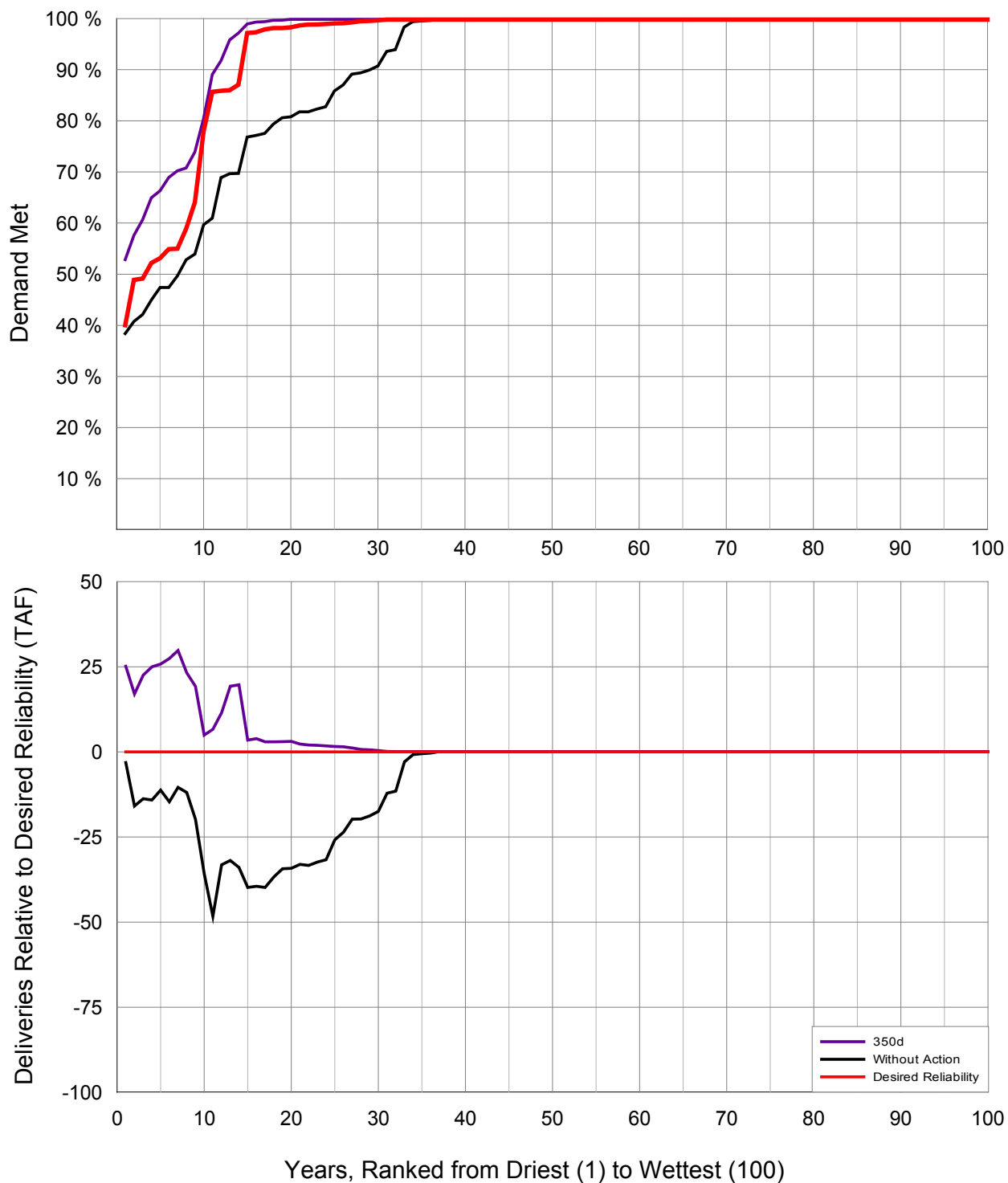


Figure 5-9. Water Supply Performance of Alternative 350.d

Project Efficiency

Alternative 350.d plans for a Project efficiency of 65 percent, and includes no actions to increase efficiency.

Seepage losses from the Truckee Canal are reduced by approximately 85 percent under this alternative.

Water Quantity and Quality on Lower Truckee River

The average annual volume of water in the lower Truckee River for Alternative 350.d is greater than that of the Desired Reliability condition but less than that of the Without-Action Alternative.

- **Relative to the Desired Reliability** – Increase in Truckee River flow of 21,000 acre-feet annually.
- **Relative to the Without-Action Alternative condition** – Decrease in Truckee River flow of 25,000 acre-feet annually.

Hydropower Generation

Hydropower generation is increased under Alternative 350.d relative to the Without-Action Alternative. Average generation at Lahontan Powerplant and 26-Foot Drop powerplant is 16,020 MWh and 4,909 MWh annually, respectively.

Preliminary Alternative Review

Environmental outcomes and regulatory requirements would be somewhat similar to those under Alternative 350.a, when compared to the Without-Action Alternative. This alternative would have a similar level of water diversion as Alternative 350.a, and similar construction effects on the Truckee Canal as alternatives 600, 350.a, and 350.b, except that concrete and geomembrane lining would be installed rather than an HDPE cutoff wall. This would result in substantially less canal seepage, which would reduce the groundwater contributions in the Truckee Division.

Environmental Outcomes

Alternative 350.d's outcomes for species and habitat in the study areas would be similar to those for alternatives 600, 350.a, and 350.b when compared to the Without-Action Alternative: species that use the Lahontan Reservoir and Carson Lake would experience increases in water quality and quantity; wetland and riparian areas adjacent to the Lahontan Reservoir and Carson Lake may increase in extent; species in the Truckee River and Pyramid Lake would experience decreases in water quantity and quality; and wetlands and riparian resources in the vicinity of the Truckee River and Pyramid Lake may decrease in extent (Reclamation 2000).

Deliveries to Lahontan Reservoir and the Carson Division would increase as compared to the Without-Action Alternative. Increased availability of groundwater and return flows within the Carson Division would benefit Stillwater NWR, similar to under alternatives 600 and 350.a when compared to the Without-action alternative. No permanent changes in land use or land cover are anticipated to occur under this scenario; therefore, no substantial changes in air quality from agricultural activities or changes in the extent of fallow land are expected to occur.

The City of Fernley relies on seepage from the Truckee Canal to replenish the local aquifer, which is used for municipal and industrial water, although this is not a valid Project delivery. Alternative 350.d's concrete geomembrane lining of the Truckee Canal would eliminate seepage into the local aquifer, thus reducing Fernley's ability to meet its total municipal demand (City of Fernley 2012). Appendix B4 contains correspondence between Reclamation and the City of Fernley regarding Fernley's reliance on seepage from the Truckee Canal.

Construction effects from the Truckee Canal safety improvements would be very similar or identical to those noted for alternatives 600, 350.a, and 350.b: construction activities could affect water quality and there is potential for construction noise to disturb nearby residents in some places.

Regulatory Review

A list of Federal, State, and local regulations that may be applicable is summarized in Table 5-1.

Federal Requirements Federal requirements for permitting and consultation are likely identical to those for Alternative 350.b: consultation with the USACE and USFWS would take place to identify permitting requirements; consultation with the Pyramid Lake Paiute and Fallon Paiute Shoshone tribes would be required related to Indian Trust Assets; and consultation with the Nevada SHPO would be required to assess any potential negative effects on NRHP-listed project features. Because of the range and complexity of potential environmental outcomes of Alternative 350.d, an EIS – rather than an EA – may be required to sufficiently evaluate effects.

State and Local Requirements State and local requirements for consultation and permitting are likely identical to those for alternatives 600, 350.a, and 350.b, potentially including: a Surface Area Disturbance Permit from NDEP, Bureau of Air Pollution; Construction Stormwater and Working in Waterways permits from NDEP, Bureau of Water Pollution Control; and encroachment permits from Lyon, Storey, or Churchill counties.

Economics

TCID Ability to Pay

Under Alternative 350.d, TCID's ability to pay is estimated at \$7.20 million annually. This is an improvement over the Without-Action Alternative of about \$2.20 million.

Preliminary Benefits

All preliminary benefits for Alternative 350.d are estimated in relation to conditions under the Without-Action Alternative. Although not quantified in the Study, safety to the City of Fernley is a primary benefit of Alternative 350.d. Benefits to agricultural, wetlands and M&I water supplies factor in the average water supply reliability of 96.3 percent that occurs under Alternative 350.d. Average annual revenue from hydropower generation increases \$0.16 million over the Without-Action Alternative. The annual benefit of increased agricultural water supply for the Project is estimated at \$1.15 million. The annual benefit of increased supply to wetlands is \$0.54 million. The annual benefit of increased M&I supply is estimated at \$0.01 million.

Implementation Considerations

Compatibility with Applicable Laws, Policies, and Plans

Alternative 350.d is anticipated to be compatible with all existing laws and policies. It is also compatible with recent Truckee Canal rehabilitation actions taken by TCID to remove the 33 existing conduits to the laterals and replace them with 17 structures that include both lateral and stock line delivery features (TCID 2012b).

It is possible that the actions in Alternative 350.d may require a more extensive NEPA evaluation before implementation (see "Preliminary Alternative Review" subsection above), such as an EIS rather than an EA.

Federal and Non-Federal Roles and Responsibilities

Reclamation would likely be the Federal lead for permitting and NEPA compliance. As the local contractor, TCID would likely obtain State and local permits related to construction activities.

Potential for Cost-Sharing

TCID TCID should be considered a potential cost-share partner because Alternative 350.d significantly increases the water supply reliability experienced by its customers, which in turn improves its hydropower generation capacity—one of the largest sources of annual revenue for the district.

City of Fernley The City of Fernley should be considered as a potential cost-share partner for at least feasibility assessments of Study alternatives. The benefit of life safety and averted flood damage reduction would serve as a portion of the benefit that the city derives from the Study alternatives.

Summary of Alternative 350.d

Table 5-9 below summarizes the performance, accomplishments, benefits, costs, and other characteristics of Alternative 350.d.

Table 5-9. Characteristics of Alternative 350.d

| | | Alternative 350.d | Without-Action Alternative | Desired Reliability Scenario |
|--|--|------------------------------------|---|-------------------------------------|
| Major Features | Truckee Canal Flow Stage | 350 cfs | 150 cfs | 900 cfs |
| | Truckee Canal HDPE Cutoff Wall or Lining | Lining | - | NA |
| | Other Features | - | - | NA |
| Safety | | Meets RR3 | Uncertain ¹¹ | NA |
| Average Annual Project Water Delivery¹ (percent) | | 96.3% | 90.5% | 94.6% |
| Average Annual Project Delivery by User Category | Ag/Irrigation (TAF) | 118.0 | 111.2 | NA |
| | M&I (TAF) | 13.3 | 13.2 | NA |
| | Lahontan Valley Wetlands ² (TAF) | 67.8 | 63.6 | NA |
| Annual Cost³ (millions) | | \$4.20 | NA | NA |
| TCID Ability-to-Pay¹² (millions) | | \$7.20 | \$5.00 | NA ⁹ |
| Preliminary Benefits⁵ (annual) | Agricultural Water Supply Reliability (millions) | \$1.15 | NA | NA |
| | Wetlands/ Environmental Water Supply Reliability ⁴ (millions) | \$0.54 | NA | NA |
| | M&I Water Supply Reliability (millions) | \$0.01 | NA | NA |
| | Hydropower Generation Revenue (millions) | \$0.16 | NA | NA |
| | Safety ⁶ | Increased | NA | NA |
| Environmental and Other Effects | Avg. Annual Spill to Stillwater NWR from Lahontan Dam (TAF) ⁷ | 13.2 | 11.0 | 12.5 |
| | Carson Division Groundwater and Agricultural Drain Flows ⁹ | Significant change not anticipated | Reduced in comparison to current conditions | Similar to current conditions |
| | City of Fernley Demand Met ⁸ (percent) | 56% | 99% | 121% |
| | Avg. Annual Flow to Pyramid Lake (TAF) | 491 | 516 | 460 ¹³ |

Table 5-9. Characteristics of Alternative 350.d (contd.)

Notes:

- ¹ Long-term average annual percent of Newlands Project demand met.
- ² Includes deliveries to Carson Lake and Pasture, the Fallon Paiute-Shoshone Tribal wetlands, and Stillwater NWR.
- ³ Annual costs include interest and amortization of the capital cost estimated over 50 years at the current federal discount rate of 4 percent. Costs also include annual operations and maintenance estimated at 0.2 percent of the field cost. For some alternatives with the Dry-Year Fallowing, annual costs for the program were estimated at \$100 per acre of land fallowing plus an administrative cost at 20 percent of the fee. For additional information, see Appendix E3.
- ⁴ Based on volume of deliveries to Carson Lake and Pasture, the Fallon Paiute-Shoshone Tribal wetlands, and Stillwater NWR, and also spills to Stillwater from Lahontan Dam. Excludes consideration of water supply from return flows and groundwater.
- ⁵ Preliminary benefits were estimated as the change between a Study alternative and the Without-Action Alternative for agricultural water supply, wetlands water supply, M&I water supply, and hydropower generation revenue. Water supply reliability under each Study alternative is factored into that alternative's benefits calculation. Benefits reported are annual, estimated over 50 years at the current Federal discount rate of 4 percent. For additional information, see appendixes D8, G1, and G2.
- ⁶ The benefits of improved safety have not been quantified for this Study, but would need to be more fully evaluated for a feasibility study or for cost-allocation purposes.
- ⁷ Spills are not considered a Project delivery, but are included in the calculation of benefits to wetlands.
- ⁸ The City of Fernley's municipal supply relies on groundwater available through incidental recharge from the Truckee Canal. While this is not a valid Project delivery, some alternatives would have the effect of reducing the availability of this groundwater. The demand met for the City of Fernley is noted as an environmental outcome. For additional information on how the Study evaluated the effects of Study alternatives on Fernley's ability to meet future demand, see Appendix B4.
- ⁹ Assessment of financial conditions was not conducted for the Desired Reliability scenario, because this scenario was developed to estimate a historical water supply reliability under current regulations and does not represent a current or future ability to pay.
- ¹⁰ Effects of alternatives on Carson Division groundwater and agricultural drain flows are not quantifiable, and are described in comparison to current conditions.
- ¹¹ The 150 cfs flow stage is believed to pose a lower risk to the Fernley area because the water elevation in the canal would be maintained at a level low enough to minimize the risk of destabilizing the canal embankment. However, this is not a solution specifically designed to reduce risk of operating the canal, and thus the degree to which it meets the safety objective (RR3) is unknown.
- ¹² Ability to pay estimates represents potential maximum increases to charges that TCID could apply to their customers while maintaining farm profitability, and are not reasonable to use as the sole basis for capital investment decisions. Ability to pay has been estimated using Reclamation guidelines and relies substantially upon the 5-year average for crop prices, which are volatile and presently on the higher end of historical ranges. For example, if alfalfa prices fell from current levels (\$155/ton) to levels experienced a decade ago (\$125/ton), TCID ability to pay could be reduced by as much as \$8.7 million per year. The estimated current ability of TCID to pay for projects and improvements beyond current obligations is \$6.50 million per year. (See Appendix G.)
- ¹³ Because the Desired Reliability scenario is based upon current demands, which are larger than the future demands used for Study alternatives, the flow to Pyramid Lake will automatically be somewhat higher for the alternatives than for the Desired Reliability scenario.

Key:

Avg. = average

cfs = cubic feet per second

M&I = municipal and industrial

NWR = National Wildlife Refuge

RR = risk rating

TAF = thousand acre-feet

TCID = Truckee Canal Irrigation District

Alternative 250.a

Components and Features

Safety

HDPE Cutoff Wall Plus Other Structural Improvements Actions included to provide for safe operations of the Truckee Canal under this alternative are identical to the actions described for alternatives 600, 350.a, and 350.b, and include the HDPE cutoff wall installed along approximately 17 miles of the canal embankment; replacement of turnout pipes, stockwater lines, and check structures; installation of check structures, wasteway turnout structures, and cross-drainages; increases in canal bank height; and removal of up to 115 trees.

Water Supply

Fallow 25 Percent of Water Rights During Dry Years Reduce demand from the Project by temporarily fallowing approximately 25 percent of water-righted Project agricultural land in dry years. Farmers who choose to forego their irrigation rights will be compensated.

Cost Estimates

The total annual cost for Alternative 250.a is \$6.5 million.¹ Table 5-10 identifies estimates for non-contract costs; and total construction, capital, and annualized costs.

¹ This cost does not reflect a potential reduction that may result from TCID's 2012 activities to replace turnout structures on the Truckee Canal. Replacement of these structures likely satisfies a portion of the actions to achieve the safety objective and could reduce the field cost by \$1.7 million, which is not reflected here.

Table 5-10. Alternative 250.a Cost Summary

| Measure Selected for Meeting the Safety Objective | Additional Measure(s) Selected for Meeting the Water Supply Objective | Estimated Cost (\$ Million) |
|---|---|-----------------------------|
| HDPE Cutoff Wall | | \$44.0 |
| | Dry-Year Crop Insurance/Fallowing: see annual program cost below | |
| TOTAL FIELD COST | | \$44.0 |
| Non-Contract Costs | | |
| Planning and Environmental Compliance ¹ | | \$4.40 |
| Engineering and Design ² | | \$4.40 |
| Construction Management ³ | | \$4.40 |
| Easements ⁴ | | \$0.40 |
| Cultural Resources ⁵ | | \$1.40 |
| TOTAL CONSTRUCTION COST | | \$59.0 |
| Interest During Construction ⁶ | | \$2.00 |
| TOTAL CAPITAL COST | | \$61.0 |
| Interest and Amortization ⁷ | | \$2.80 |
| Annual Operations and Maintenance ⁸ | | \$0.10 |
| Dry-Year Crop Insurance/Fallowing Program ⁹ (25% demand reduction) | | \$3.60 |
| TOTAL ANNUAL COST | | \$6.50 |

Note:

Cost estimate is appraisal-level and subject to change in the future. Appraisal-level cost estimates are not suitable for requesting project authorization and/or construction fund appropriations. Cost estimate is presented in January 2012 dollars, and may have discrepancies due to rounding.

¹ 10 percent of the field cost was estimated for Planning and Environmental Compliance non-contract costs.

² 10 percent of the field cost was estimated for Engineering and Design non-contract costs.

³ 10 percent of the field cost was estimated for Construction Management non-contract costs.

⁴ 1 percent of the field cost was estimated for Easements non-contract costs.

⁵ 3 percent of the field cost was estimated for Cultural Resources non-contract costs.

⁶ Interest During Construction was estimated over 2 years of construction at the current Federal discount rate of 4 percent.

⁷ Interest and Amortization of the capital cost was estimated over 50 years at the current Federal discount rate of 4 percent.

⁸ Annual Operations and Maintenance costs were estimated at 0.2 percent of the field cost.

⁹ Dry-Year Crop Insurance/Fallowing Program annual cost is estimated at \$100 per acre of land following plus an administrative cost at 20 percent of the fee. This alternative would require 25 percent demand reduction in Truckee and Carson Division agriculture.

Key:

\$ million = million dollars

HDPE = high-density polyethylene

Accomplishments

Safety

Alternative 250.a and all other alternatives formulated and selected by the Study meet the RR3 level of risk reduction required to achieve the Study's safety objective.

Water Supply

Iterations of Alternative 250.a showed that fallowing 25 percent of water-righted agricultural land in dry years is sufficient to achieve a desired level of reliability (see Appendix F). Alternative 250.a meets or exceeds both of the conditions needed to achieve the Study's water supply objective: (1) the long-term average delivery of Project water (95.7 percent) exceeds that of the Desired Reliability scenario (94.6 percent); and (2) as shown in Figure 5-10, the largest annual difference in supply relative to the Desired Reliability scenario is approximately negative-9,000 acre-feet, which meets the desired negative-10,000 acre-foot threshold.

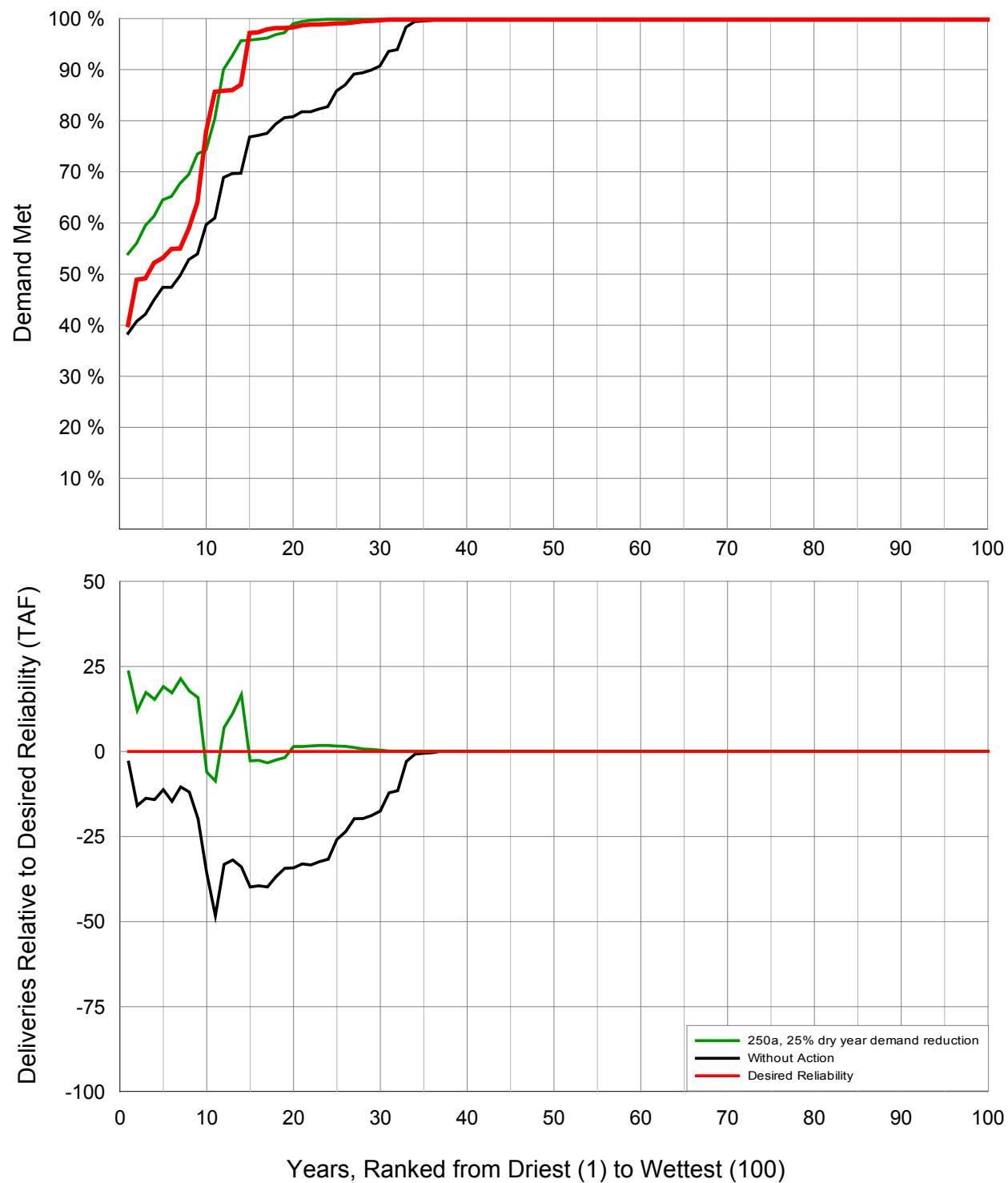


Figure 5-10. Water Supply Performance of Alternative 250.a

Project Efficiency

Alternative 250.a plans for a Project efficiency of 65 percent, and includes no actions to increase efficiency.

Seepage losses from the Truckee Canal are not reduced under this alternative.

Water Quantity and Quality on Lower Truckee River

The average annual volume of water in the lower Truckee River for Alternative 250.a is greater than that of the Desired Reliability condition but less than that of the Without-Action Alternative.

- **Relative to the Desired Reliability** – Increase in Truckee River flow of 28,000 acre-feet annually.
- **Relative to the Without-Action Alternative condition** – Decrease in Truckee River flow of 18,000 acre-feet annually.

Hydropower Generation

Annual hydropower generation is increased under Alternative 250.a relative to the Without-Action Alternative. Average generation at Lahontan Powerplant and 26-Foot Drop powerplant is 15,065 MWh and 4,722 MWh annually, respectively.

Preliminary Alternative Review

Environmental outcomes and regulatory requirements would be very similar to those under Alternative 350.a, when compared to the Without-Action Alternative. The Truckee Canal would be operated at a greater level than under the Without-Action Alternative, but at a lower level than the 350 cfs alternatives. Therefore, compared to the Without-Action Alternative, Lahontan Reservoir inflows and Carson River flows would increase, and Truckee River flows and Pyramid Lake inflows would decrease, but to a lesser extent than under the 350 cfs alternatives. Construction activities related to safety measures would be identical to those under Alternative 350.a. In addition, agricultural lands would be retired or fallowed.

Environmental Outcomes

Alternative 250.a's outcomes for species and habitat in the study areas would be similar to those for Alternatives 350.a, 350.b, and 350.d, when compared to the Without-Action Alternative: species that use the Lahontan Reservoir and Carson Lake would experience increases in water quality and quantity; wetland and riparian areas adjacent to the Lahontan Reservoir and Carson Lake may increase in extent; species in the Truckee River and Pyramid Lake would experience decreases in water quantity and quality; and wetlands and riparian resources in the vicinity of the Truckee River and Pyramid Lake may decrease in extent (Reclamation 2000).

Deliveries to Lahontan Reservoir and the Carson Division would increase as compared to the Without-Action Alternative. Increased water availability within the Carson Division and return flows from agricultural users would benefit Stillwater NWR when compared to the Without-action alternative. Irrigation return flows may increase groundwater availability. Benefits of increased groundwater and drain flows would be less than under the 350 and 600 cfs alternatives, however, and would be offset by reduced return flows related to temporary land fallowing during dry years (Churchill County 2012).

Changes in land cover could also result in decreases in air quality from an increase in fugitive dust produced on fallow land (Churchill County 2012). This may be offset to some degree by reductions in air quality effects from agriculture, including application of agricultural chemicals, hydrocarbon emissions from vehicles and machinery, soot and ash from agricultural burning, and fugitive dust created by farm equipment; however, it is expected that the net effect of temporary land fallowing on air quality would be negative. Other temporary effects from fallowing could include an increase in noxious weeds, and decreased revenue for local businesses that support the agricultural industry (Churchill County 2012). Weeds and dust effects could be mitigated to some degree by continuing to apply some amount of water to the land (Brad Goetsch and Eleanor Lockwood, Churchill County, personal communication, August 25, 2011; public comments, August 2011). Previous examples of this effect within the Newlands Project include a portion of Swingle Bench where USFWS acquired and retired land without implementing such mitigation measures (public comments, August 2011).

The City of Fernley relies on seepage from the Truckee Canal to replenish the local aquifer, which is used for M&I purposes, although this is not a valid Project delivery. Studies have estimated that a minimum flow of 350 cfs is needed in the Truckee Canal to accommodate the level of aquifer recharge required for the City of Fernley to continue receiving an adequate level of municipal water withdrawals (City of Fernley 2012). The 250 cfs alternatives are also below the level needed to meet the City of Fernley's aquifer recharge needs, thus potentially reducing Fernley's ability to meet its total municipal demand. Appendix B4 contains correspondence between Reclamation and the City of Fernley regarding Fernley's reliance on seepage from the Truckee Canal.

Construction effects from the Truckee Canal safety improvements would be identical to those noted for alternatives 600, 350.a, and 350.b: construction activities could affect water quality and there is potential for construction noise to disturb nearby residents in some places.

Regulatory Review

A list of Federal, State, and local regulations that may be applicable is summarized in Table 5-1.

Federal Requirements Federal requirements for permitting and consultation are likely identical to those for alternatives 600, 350.a, and 350.b: consultation with the USACE and USFWS would take place to identify permitting requirements; consultation with the Pyramid Lake Paiute and Fallon Paiute Shoshone tribes would be required related to Indian Trust Assets; and consultation with the Nevada SHPO would be required to assess any potential negative effects on NRHP-listed project features. NEPA compliance would be necessary, but potential project effects may be able to be adequately addressed with an EA. Because of the range and complexity of potential environmental outcomes of Alternative 250.a, an EIS – rather than an EA – may be required to sufficiently evaluate effects.

State and Local Requirements State and local requirements for consultation and permitting are likely identical to those for alternatives 600, 350.a, 350.b, and 350.d, potentially including: a Surface Area Disturbance Permit from NDEP, Bureau of Air Pollution; Construction Stormwater and Working in Waterways permits from NDEP, Bureau of Water Pollution Control; and encroachment permits from Lyon, Storey, or Churchill counties.

Economics

TCID Ability to Pay

Under Alternative 250.a, TCID's ability to pay is estimated at \$6.90 million annually. This is an improvement over the Without-Action Alternative of about \$1.90 million.

Preliminary Benefits

All preliminary benefits for Alternative 250.a are estimated in relation to conditions under the Without-Action Alternative. Although not quantified in the Study, safety to the City of Fernley is a primary benefit of Alternative 250.a. Benefits to agricultural, wetlands and M&I water supplies factor in the average water supply reliability of 95.7 percent that occurs under Alternative 250.a. Average annual revenue from hydropower generation increases \$0.09 million over the Without-Action Alternative. The annual benefit of increased agricultural water supply for the Project is estimated at \$1.05 million. The annual benefit of increased supply to wetlands is \$0.54 million. The annual benefit of increased M&I supply is estimated at \$0.01 million.

Implementation Considerations

Compatibility with Applicable Laws, Policies, and Plans

Alternative 250.a is anticipated to be compatible with all existing laws and policies. It is also compatible with recent Truckee Canal rehabilitation actions taken by TCID to remove the 33 existing conduits to the laterals and replace them with 17 structures that include both lateral and stock line delivery features (TCID 2012b).

It is possible that the actions in Alternative 250.a may require a more extensive NEPA evaluation before implementation (see “Preliminary Alternative Review” subsection above), such as an EIS rather than an EA.

Federal and Non-Federal Roles and Responsibilities

Reclamation would likely be the Federal lead for permitting and NEPA compliance. As the local contractor, TCID would likely obtain State and local permits related to construction activities.

Potential for Cost-Sharing

TCID TCID should be considered a potential cost-share partner because Alternative 250.a significantly increases the water supply reliability experienced by its customers, which in turn improves its hydropower generation capacity—one of the largest sources of annual revenue for the district.

City of Fernley The City of Fernley should be considered as a potential cost-share partner for this Study alternative. The benefit of life safety and averted flood damage reduction would serve as a portion of the benefit that the city derives from Alternative 250.a. Additionally, Fernley receives the incidental benefit of continued seepage from the Truckee Canal into the local aquifer. By implementing this alternative, instead of another alternative that lines the Truckee Canal and reduces seepage, the city avoids the cost of replacing the groundwater supplies that they rely on.

Pyramid Lake Paiute Tribe The Pyramid Lake Paiute Tribe should be considered as a potential cost-share partner. Among the range of alternatives available for meeting the Study objectives, Alternative 250.a maintains a relatively high level of flows to Pyramid Lake.

Summary of Alternative 250.a

Table 5-4 below summarizes the performance, accomplishments, benefits, costs, and other characteristics of Alternative 250.a.

Table 5-11. Characteristics of Alternative 250.a

| | | Alternative 250.a | Without-Action Alternative | Desired Reliability Scenario |
|--|--|------------------------------|---|---|
| Major Features | Truckee Canal Flow Stage | 250 cfs | 150 cfs | 900 cfs |
| | Truckee Canal HDPE Cutoff Wall or Lining | HDPE Cutoff Wall | - | NA |
| | Other Features | Following 25% in Dry Years | - | NA |
| Safety | | Meets RR3 | Uncertain ¹² | NA |
| Average Annual Project Water Delivery¹ (percent) | | 95.7% | 90.5% | 94.6% |
| Average Annual Project Delivery by User Category | Ag/Irrigation (TAF) | 112.4 | 111.2 | NA |
| | M&I (TAF) | 13.3 | 13.2 | NA |
| | Lahontan Valley Wetlands ² (TAF) | 67.4 | 63.6 | NA |
| Annual Cost³ (millions) | | \$6.50 | NA | NA |
| TCID Ability-to-Pay¹³ (millions) | | \$6.90 | \$5.00 | NA ¹⁰ |
| Preliminary Benefits⁶ (annual) | Agricultural Water Supply Reliability (millions) | \$1.05 | NA | NA |
| | Wetlands/ Environmental Water Supply Reliability ⁴ (millions) | \$0.37 ⁵ | NA | NA |
| | M&I Water Supply Reliability (millions) | \$0.01 | NA | NA |
| | Hydropower Generation Revenue (millions) | \$0.09 | NA | NA |
| | Safety ⁷ | Increased | NA | NA |
| Environmental and Other Effects | Avg. Annual Spill to Stillwater NWR from Lahontan Dam (TAF) ⁸ | 11.6 | 11.0 | 12.5 |
| | Carson Division Groundwater and Agricultural Drain Flows ¹¹ | Reduced by following | Reduced in comparison to current conditions | Similar to current conditions |
| | City of Fernley Demand Met ⁹ (percent) | 105% | 99% | 121% |
| | Avg. Annual Flow to Pyramid Lake (TAF) | 498 | 516 | 460 ¹⁴ |

Table 5-11. Characteristics of Alternative 250.a (contd.)

Notes:

- ¹ Long-term average annual percent of Newlands Project demand met.
- ² Includes deliveries to Carson Lake and Pasture, the Fallon Paiute-Shoshone Tribal wetlands, and Stillwater NWR.
- ³ Annual costs include interest and amortization of the capital cost estimated over 50 years at the current federal discount rate of 4 percent. Costs also include annual operations and maintenance estimated at 0.2 percent of the field cost. For some alternatives with the Dry-Year Fallowing, annual costs for the program were estimated at \$100 per acre of land fallowing plus an administrative cost at 20 percent of the fee. For additional information, see Appendix E3.
- ⁴ Based on volume of deliveries to Carson Lake and Pasture, the Fallon Paiute-Shoshone Tribal wetlands, and Stillwater NWR, and also spills to Stillwater from Lahontan Dam. Excludes consideration of water supply from return flows and groundwater.
- ⁵ May be lower due to reductions in other supply sources resulting from implementation of Study alternatives, but which could not be quantified.
- ⁶ Preliminary benefits were estimated as the change between a Study alternative and the Without-Action Alternative for agricultural water supply, wetlands water supply, M&I water supply, and hydropower generation revenue. Water supply reliability under each Study alternative is factored into that alternative's benefits calculation. Benefits reported are annual, estimated over 50 years at the current Federal discount rate of 4 percent. For additional information, see appendixes D8, G1, and G2.
- ⁷ The benefits of improved safety have not been quantified for this Study, but would need to be more fully evaluated for a feasibility study or for cost-allocation purposes.
- ⁸ Spills are not considered a Project delivery, but are included in the calculation of benefits to wetlands.
- ⁹ The City of Fernley's municipal supply relies on groundwater available through incidental recharge from the Truckee Canal. While this is not a valid Project delivery, some alternatives would have the effect of reducing the availability of this groundwater. The demand met for the City of Fernley is noted as an environmental outcome. For additional information on how the Study evaluated the effects of Study alternatives on Fernley's ability to meet future demand, see Appendix B4.
- ¹⁰ Assessment of financial conditions was not conducted for the Desired Reliability scenario, because this scenario was developed to estimate a historical water supply reliability under current regulations and does not represent a current or future ability to pay.
- ¹¹ Effects of alternatives on Carson Division groundwater and agricultural drain flows are not quantifiable, and are described in comparison to current conditions.
- ¹² The 150 cfs flow stage is believed to pose a lower risk to the Fernley area because the water elevation in the canal would be maintained at a level low enough to minimize the risk of destabilizing the canal embankment. However, this is not a solution specifically designed to reduce risk of operating the canal, and thus the degree to which it meets the safety objective (RR3) is unknown.
- ¹³ Ability to pay estimates represents potential maximum increases to charges that TCID could apply to their customers while maintaining farm profitability, and are not reasonable to use as the sole basis for capital investment decisions. Ability to pay has been estimated using Reclamation guidelines and relies substantially upon the 5-year average for crop prices, which are volatile and presently on the higher end of historical ranges. For example, if alfalfa prices fell from current levels (\$155/ton) to levels experienced a decade ago (\$125/ton), TCID ability to pay could be reduced by as much as \$8.7 million per year. The estimated current ability of TCID to pay for projects and improvements beyond current obligations is \$6.50 million per year. (See Appendix G.)
- ¹⁴ Because the Desired Reliability scenario is based upon current demands, which are larger than the future demands used for Study alternatives, the flow to Pyramid Lake will automatically be somewhat higher for the alternatives than for the Desired Reliability scenario.

Key:

Avg. = average
cfs = cubic feet per second
M&I = municipal and industrial
NWR = National Wildlife Refuge
RR = risk rating
TAF = thousand acre-feet
TCID = Truckee Canal Irrigation District

Alternative 250.b

Components and Features

Safety

HDPE Cutoff Wall Plus Other Structural Improvements Actions included to provide for safe operations of the Truckee Canal under this alternative are identical to the actions described for alternatives 600, 350.a, 350.b, and 250.a, and include the HDPE cutoff wall installed along approximately 17 miles of the canal embankment; replacement of turnout pipes, stockwater lines, and check structures; installation of check structures, wasteway turnout structures, and cross-drainages; increases in canal bank height; and removal of up to 115 trees.

Water Supply

Line Carson Division's Main Canals and Laterals Line 44.9 miles of conveyance facilities in the Carson Division with a 4-inch concrete geomembrane liner, consistent with the "Option 1 Expanded" recommendation in the *Newlands Project Efficiency Study* (Reclamation 1994). This includes portions of the V, S, L, and A canals, and part of the L1 lateral—facilities in which conveyance losses due to seepage are greatest, based on conclusions of the Efficiency Study. The extent of canal and lateral lining is the same as is described under Alternative 350.b, above.

Cost Estimates

The total annual cost for Alternative 250.b is \$15 million.¹ Table 5-12 identifies estimates for non-contract costs; and total construction, capital, and annualized costs.

¹ This cost does not reflect a potential reduction that may result from TCID's 2012 activities to replace turnout structures on the Truckee Canal. Replacement of these structures likely satisfies a portion of the actions to achieve the safety objective and could reduce the field cost by \$1.7 million, which is not reflected here.

Table 5-12. Alternative 250.b Cost Summary

| Measure Selected for Meeting the Safety Objective | Additional Measure(s) Selected for Meeting the Water Supply Objective | Estimated Cost (\$ Million) |
|--|--|------------------------------------|
| HDPE Cutoff Wall | | \$44.0 |
| | Line Main Canals and Laterals | \$165.0 |
| TOTAL FIELD COST | | \$210.0 |
| Non-Contract Costs | | |
| Planning and Environmental Compliance ¹ | | \$10.0 |
| Engineering and Design ² | | \$21.0 |
| Construction Management ³ | | \$21.0 |
| Easements ⁴ | | \$2.00 |
| Cultural Resources ⁵ | | \$6.00 |
| TOTAL CONSTRUCTION COST | | \$270.0 |
| Interest During Construction ⁶ | | \$50.0 |
| TOTAL CAPITAL COST | | \$320.0 |
| Interest and Amortization ⁷ | | \$14.5 |
| Annual Operations and Maintenance ⁸ | | \$0.50 |
| TOTAL ANNUAL COST | | \$15.0 |

Note:

Cost estimate is appraisal-level and subject to change in the future. Appraisal-level cost estimates are not suitable for requesting project authorization and/or construction fund appropriations. Cost estimate is presented in January 2012 dollars, and may have discrepancies due to rounding.

¹ 5 percent of the field cost was estimated for Planning and Environmental Compliance non-contract costs.

² 10 percent of the field cost was estimated for Engineering and Design non-contract costs.

³ 10 percent of the field cost was estimated for Construction Management non-contract costs.

⁴ 1 percent of the field cost was estimated for Easements non-contract costs.

⁵ 3 percent of the field cost was estimated for Cultural Resources non-contract costs.

⁶ Interest During Construction was estimated over 8 years of construction at the current Federal discount rate of 4 percent.

⁷ Interest and Amortization of the capital cost was estimated over 50 years at the current Federal discount rate of 4 percent.

⁸ Annual Operations and Maintenance costs were estimated at 0.2 percent of the field cost.

Key:

\$ million = million dollars

HDPE = high-density polyethylene

Accomplishments

Safety

Alternative 250.b and all other alternatives formulated and selected by the Study meet the RR3 level of risk reduction required to achieve the Study's safety objective.

Water Supply

Alternative 250.b meets or exceeds both of the conditions needed to achieve the Study's water supply objective: (1) the long-term average delivery of Project water (96.2 percent) exceeds that of the Desired Reliability scenario (94.6 percent); and (2) as shown in Figure 5-11, deliveries for Alternative 250.b exceed those for the Desired Reliability for each of the 100 years evaluated.

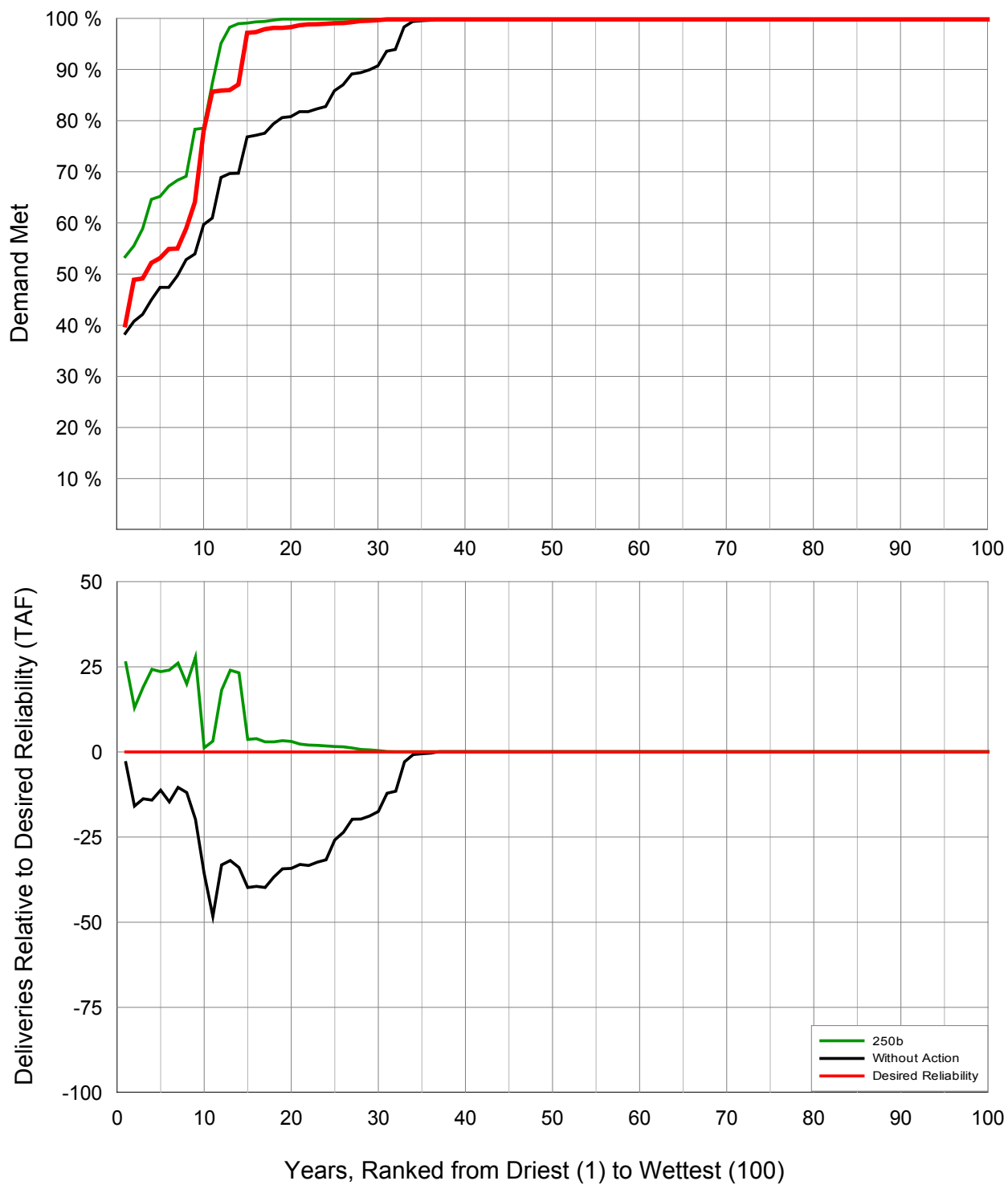


Figure 5-11. Water Supply Performance of Alternative 250.b

Project Efficiency

Alternative 250.b plans for increasing Project efficiency to 75 percent, with the associated increases in water supply being dedicated to Project water users.

Seepage losses from the Truckee Canal are not reduced under this alternative.

Water Quantity and Quality on Lower Truckee River

The average annual volume of water in the lower Truckee River for Alternative 250.b is close to that of the Without-Action Alternative.

- **Relative to the Desired Reliability** – Increase in Truckee River flow of 42,000 acre-feet annually.
- **Relative to the Without-Action Alternative condition** – Decrease in Truckee River flow of 4,000 acre-feet annually.

Hydropower Generation

Hydropower generation is increased under Alternative 250.b relative to the Without-Action Alternative. Average generation at Lahontan Powerplant and 26-Foot Drop powerplant is 14,696 MWh and 4,276 MWh annually, respectively.

Preliminary Alternative Review

Environmental outcomes and regulatory requirements would be similar to those under the 350.b alternative, when compared to the Without-Action Alternative. However, the Truckee Canal would be operated at a lower level than under 350.b, though still at a greater level than under the Without-Action Alternative. Therefore, compared to the Without-Action Alternative, Lahontan Reservoir inflows and Carson River flows would increase, and Truckee River flows and Pyramid Lake inflows would decrease, but to a lesser extent than under the 350 cfs alternatives. Reductions to groundwater availability in the Carson Division related to Carson Division canal lining would be the same as under Alternative 350.b. Construction activities related to safety measures would be identical to those under the 350.b cfs alternative.

Environmental Outcomes

Alternative 250.b's outcomes for species and habitat in the study areas would be similar to those for alternatives 600, 350.a, 350.b, and 350.d when compared to the Without-Action Alternative: species that use the Lahontan Reservoir and Carson Lake would experience increases in water quality and quantity; wetland and riparian areas adjacent to the Lahontan Reservoir and Carson Lake may increase in extent; species in the Truckee River and Pyramid Lake would experience decreases in water quantity and quality; and wetlands and riparian resources in the vicinity of the Truckee River and Pyramid Lake may decrease in extent (Reclamation 2000).

No agricultural land retirement or fallowing is expected to occur under this scenario. Because of the increased Truckee Canal flows as compared to the Without-Action Alternative, irrigation return flows would be greater than under the Without-Action Alternative, and may increase groundwater availability in the Truckee Division. No substantial changes in land use or land cover are anticipated to occur under this scenario; therefore, no substantial changes in air quality from agricultural activities or changes in the extent of fallow land are expected to occur.

Deliveries to Lahontan Reservoir and the Carson Division would increase as compared to the Without-Action Alternative, which would benefit Stillwater NWR. Increased availability of groundwater and return flows within the Carson Division and would be identical or very similar under Alternative 250.b as under alternatives 600, 350.a, 350.d, and 250.a when compared to the Without-action alternative.

As with Alternative 350.b, this could be offset, however, by a reduction in seepage noted above from the main canals and laterals in the Carson Division, which could affect the reliability of local groundwater supplies for the City of Fallon, Churchill County, and NAS Fallon (Brad Goetsch and Eleanor Lockwood, Churchill County, personal communication, August 25, 2011). No permanent changes in land use or land cover are anticipated to occur under this scenario; therefore, no substantial changes in air quality from agricultural activities or changes in the extent of fallow land are expected to occur.

Additionally, as with Alternative 350.b, it is possible that with a reduction in groundwater, some Project landowners may seek to have their land reclassified from bottom land to bench land (public comments, August 2011). However, this Study has noted that even if a large proportion of Project lands were to be reclassified, the overall effect on Project demand would an increase of about 2 percent (see Appendix D4).

Outcomes for the City of Fernley's non-Project municipal supply, which relies on seepage from the Truckee Canal to replenish the local groundwater aquifer, would be similar to those for Alternative 250.a when compared to the Without-Action Alternative. The 250 cfs alternatives are also below the level of water that is needed in the canal to meet the City of Fernley's aquifer recharge needs, thus potentially reducing Fernley's ability to meet its total municipal demand (City of Fernley 2012). Appendix B4 contains correspondence between Reclamation and the City of Fernley regarding Fernley's reliance on seepage from the Truckee Canal.

Construction effects from the Truckee Canal safety improvements would be identical to those noted for alternatives 600, 350.a, 350.b, and 250.a: construction activities could affect water quality and there is potential for construction noise to disturb nearby residents in some places. As with Alternative 350.b, construction activities associated with canal lining in the

Carson Division would result in similar effects to those related to the Truckee Canal, but in a larger geographic area.

Regulatory Review

A list of Federal, State, and local regulations that may be applicable is summarized in Table 5-1.

Federal Requirements Federal requirements for permitting and consultation are identical to those for alternatives 350.b and 250.a: consultation with the USACE and USFWS would take place to identify permitting requirements; consultation with the Pyramid Lake Paiute and Fallon Paiute Shoshone tribes would be required related to Indian Trust Assets; and consultation with the Nevada SHPO would be required to assess any potential negative effects on NRHP-listed project features. NEPA compliance would be necessary, and an EIS may be required to sufficiently evaluate effects.

State and Local Requirements State and local requirements for consultation and permitting are likely identical to those for all other alternatives, potentially including: a Surface Area Disturbance Permit from NDEP, Bureau of Air Pollution; Construction Stormwater and Working in Waterways permits from NDEP, Bureau of Water Pollution Control; and encroachment permits from Lyon, Storey, or Churchill counties.

Economics

TCID Ability to Pay

Under Alternative 250.b, TCID's ability to pay is estimated at \$7.00 million annually. This is an improvement over the Without-Action Alternative of about \$2.00 million.

Preliminary Benefits

All preliminary benefits for Alternative 250.b are estimated in relation to conditions under the Without-Action Alternative. Although not quantified in the Study, safety to the City of Fernley is a primary benefit of Alternative 250.b. Benefits to agricultural, wetlands and M&I water supplies factor in the average water supply reliability of 96.2 percent that occurs under Alternative 250.b. Average annual revenue from hydropower generation increases \$0.04 million over the Without-Action Alternative. The annual benefit of increased agricultural water supply for the Project is estimated at \$1.15 million. The annual benefit of increased supply to wetlands is \$0.61 million. The annual benefit of increased M&I supply is estimated at \$0.01 million.

Implementation Considerations

Compatibility with Applicable Laws, Policies, and Plans

Alternative 250.b is anticipated to be compatible with all existing laws and policies. It is also compatible with recent Truckee Canal rehabilitation actions taken by TCID to remove the 33 existing conduits to the laterals and replace

them with 17 structures that include both lateral and stock line delivery features (TCID 2012b).

It is possible that the actions in alternative 250.b may require a more extensive NEPA evaluation before implementation (see “Preliminary Alternative Review” subsection above), such as an EIS rather than an EA.

Federal and Non-Federal Roles and Responsibilities

Reclamation would likely be the Federal lead for permitting and NEPA compliance. As the local contractor, TCID would likely obtain State and local permits related to construction activities.

Potential for Cost-Sharing

TCID TCID should be considered a potential cost-share partner because Alternative 250.b significantly increases the water supply reliability experienced by its customers, which in turn improves its hydropower generation capacity—one of the largest sources of annual revenue for the district.

City of Fernley The City of Fernley should be considered as a potential cost-share partner for this Study alternative. The benefit of life safety and averted flood damage reduction would serve as a portion of the benefit that the city derives from Alternative 250.b. Additionally, Fernley receives the incidental benefit of continued seepage from the Truckee Canal into the local aquifer. By implementing this alternative, instead of another alternative that lines the Truckee Canal and reduces seepage, the city avoids the cost of replacing the groundwater supplies that they rely on.

Pyramid Lake Paiute Tribe The Pyramid Lake Paiute Tribe should be considered as a potential cost-share partner. Among the range of alternatives available for meeting the Study objectives, Alternative 250.b maintains the highest flows to Pyramid Lake.

Summary of Alternative 250.b

Table 5-13 below summarizes the performance, accomplishments, benefits, costs, and other characteristics of Alternative 250.b.

Table 5-13. Characteristics of Alternative 250.b

| | | Alternative 250.b | Without-Action Alternative | Desired Reliability Scenario |
|--|--|---|---|-------------------------------------|
| Major Features | Truckee Canal Flow Stage | 250 cfs | 150 cfs | 900 cfs |
| | Truckee Canal HDPE Cutoff Wall or Lining | HDPE Cutoff Wall | - | NA |
| | Other Features | Lining 45 miles of Carson Division canals | - | NA |
| Safety | | Meets RR3 | Uncertain ¹² | NA |
| Average Annual Project Water Delivery¹ (percent) | | 96.2% | 90.5% | 94.6% |
| Average Annual Project Delivery by User Category | Avg. Annual Deliveries to Ag/Irrigation (TAF) | 118.0 | 111.2 | NA |
| | Avg. Annual Deliveries to M&I (TAF) | 13.3 | 13.2 | NA |
| | Avg. Annual Deliveries to Lahontan Valley Wetlands ² (TAF) | 67.8 | 63.6 | NA |
| Annual Cost³ (millions) | | \$15.00 | NA | NA |
| TCID Ability-to-Pay¹³ (millions) | | \$7.00 | \$5.00 | NA ¹⁰ |
| Preliminary Benefits⁶ (annual) | Agricultural Water Supply Reliability (millions) | \$1.15 | NA | NA |
| | Wetlands/ Environmental Water Supply Reliability ⁴ (millions) | \$0.61 ⁵ | NA | NA |
| | M&I Water Supply Reliability (millions) | \$0.01 | NA | NA |
| | Hydropower Generation Revenue (millions) | \$0.04 | NA | NA |
| | Safety ⁷ | Increased | NA | NA |
| Environmental and Other Effects | Avg. Annual Spill to Stillwater NWR from Lahontan Dam (TAF) ⁸ | 13.94 | 11.00 | 12.5 |
| | Carson Division Groundwater and Agricultural Drain Flows ¹¹ | Reduced by lining Carson Division canals | Reduced in comparison to current conditions | Similar to current conditions |
| | City of Fernley Demand Met ⁹ (percent) | 105% | 99% | 121% |
| | Avg. Annual Flow to Pyramid Lake (TAF) | 512 | 516 | 460 ¹⁴ |

Table 5-13. Characteristics of Alternative 250.b (contd.)

Notes:

- ¹ Long-term average annual percent of Newlands Project demand met.
- ² Includes deliveries to Carson Lake and Pasture, the Fallon Paiute-Shoshone Tribal wetlands, and Stillwater NWR.
- ³ Annual costs include interest and amortization of the capital cost estimated over 50 years at the current federal discount rate of 4 percent. Costs also include annual operations and maintenance estimated at 0.2 percent of the field cost. For some alternatives with the Dry-Year Fallowing, annual costs for the program were estimated at \$100 per acre of land fallowing plus an administrative cost at 20 percent of the fee. For additional information, see Appendix E3.
- ⁴ Based on volume of deliveries to Carson Lake and Pasture, the Fallon Paiute-Shoshone Tribal wetlands, and Stillwater NWR, and also spills to Stillwater from Lahontan Dam. Excludes consideration of water supply from return flows and groundwater.
- ⁵ May be lower due to reductions in other supply sources resulting from implementation of Study alternatives, but which could not be quantified.
- ⁶ Preliminary benefits were estimated as the change between a Study alternative and the Without-Action Alternative for agricultural water supply, wetlands water supply, M&I water supply, and hydropower generation revenue. Water supply reliability under each Study alternative is factored into that alternative's benefits calculation. Benefits reported are annual, estimated over 50 years at the current Federal discount rate of 4 percent. For additional information, see appendixes D8, G1, and G2.
- ⁷ The benefits of improved safety have not been quantified for this Study, but would need to be more fully evaluated for a feasibility study or for cost-allocation purposes.
- ⁸ Spills are not considered a Project delivery, but are included in the calculation of benefits to wetlands.
- ⁹ The City of Fernley's municipal supply relies on groundwater available through incidental recharge from the Truckee Canal. While this is not a valid Project delivery, some alternatives would have the effect of reducing the availability of this groundwater. The demand met for the City of Fernley is noted as an environmental outcome. For additional information on how the Study evaluated the effects of Study alternatives on Fernley's ability to meet future demand, see Appendix B4.
- ¹⁰ Assessment of financial conditions was not conducted for the Desired Reliability scenario, because this scenario was developed to estimate a historical water supply reliability under current regulations and does not represent a current or future ability to pay.
- ¹¹ Effects of alternatives on Carson Division groundwater and agricultural drain flows are not quantifiable, and are described in comparison to current conditions.
- ¹² The 150 cfs flow stage is believed to pose a lower risk to the Fernley area because the water elevation in the canal would be maintained at a level low enough to minimize the risk of destabilizing the canal embankment. However, this is not a solution specifically designed to reduce risk of operating the canal, and thus the degree to which it meets the safety objective (RR3) is unknown.
- ¹³ Ability to pay estimates represents potential maximum increases to charges that TCID could apply to their customers while maintaining farm profitability, and are not reasonable to use as the sole basis for capital investment decisions. Ability to pay has been estimated using Reclamation guidelines and relies substantially upon the 5-year average for crop prices, which are volatile and presently on the higher end of historical ranges. For example, if alfalfa prices fell from current levels (\$155/ton) to levels experienced a decade ago (\$125/ton), TCID ability to pay could be reduced by as much as \$8.7 million per year. The estimated current ability of TCID to pay for projects and improvements beyond current obligations is \$6.50 million per year. (See Appendix G.)
- ¹⁴ Because the Desired Reliability scenario is based upon current demands, which are larger than the future demands used for Study alternatives, the flow to Pyramid Lake will automatically be somewhat higher for the alternatives than for the Desired Reliability scenario.

Key:

Avg. = average
cfs = cubic feet per second
M&I = municipal and industrial
NWR = National Wildlife Refuge
RR = risk rating
TAF = thousand acre-feet
TCID = Truckee Canal Irrigation District

Alternative 250.d

Components and Features

Safety

Actions included to provide for safe operations of the Truckee Canal under this alternative are identical to the actions described for alternative 350.d, and include the concrete geomembrane liner installed along approximately 17 miles of the canal; replacement of turnout pipes, stockwater lines, and check structures; installation of check structures, wasteway turnout structures, and cross-drainages; increases in canal bank height; and removal of up to 115 trees.

Water Supply

Line Truckee Canal As described for safety purposes above, line approximately 17 miles of the Truckee Canal with an impermeable membrane covered by unreinforced concrete.

Fallow 10 Percent of Water Rights During Dry Years Reduce demand from the Project by temporarily fallowing approximately 10 percent of water-righted Project agricultural land in dry years. Farmers who choose to forego their irrigation rights will be compensated.

Cost Estimates

The total annual cost for Alternative 250.d is \$5.6 million.¹ Table 5-14 identifies estimates for non-contract costs; and total construction, capital, and annualized costs.

¹ This cost does not reflect a potential reduction that may result from TCID's 2012 activities to replace turnout structures on the Truckee Canal. Replacement of these structures likely satisfies a portion of the actions to achieve the safety objective and could reduce the field cost by \$1.7 million, which is not reflected here.

Table 5-14. Alternative 250.d Cost Summary

| Measure Selected for Meeting the Safety Objective | Additional Measure(s) Selected for Meeting the Water Supply Objective | Estimated Cost (\$ Million) |
|--|---|-----------------------------|
| Concrete/ Geomembrane Lining | | \$59.00 |
| | Dry-Year Crop Insurance/Fallowing: see annual program cost below | |
| TOTAL FIELD COST | | \$59.00 |
| Non-Contract Costs | | |
| Planning and Environmental Compliance ¹ | | \$7.00 |
| Engineering and Design ² | | \$5.80 |
| Construction Management ³ | | \$5.80 |
| Easements ⁴ | | \$0.60 |
| Cultural Resources ⁵ | | \$1.80 |
| TOTAL CONSTRUCTION COST | | \$80.0 |
| Interest During Construction ⁶ | | \$7.00 |
| TOTAL CAPITAL COST | | \$87.0 |
| Interest and Amortization ⁷ | | \$4.00 |
| Annual Operations and Maintenance ⁸ | | \$0.10 |
| Dry-Year Crop Insurance/Fallowing Program ⁹ | | \$1.50 |
| TOTAL ANNUAL COST | | \$5.60 |

Note:

Cost estimate is appraisal-level and subject to change in the future. Appraisal-level cost estimates are not suitable for requesting project authorization and/or construction fund appropriations. Cost estimate is presented in January 2012 dollars, and may have discrepancies due to rounding.

¹ 12 percent of the field cost was estimated for Planning and Environmental Compliance non-contract costs.

² 10 percent of the field cost was estimated for Engineering and Design non-contract costs.

³ 10 percent of the field cost was estimated for Construction Management non-contract costs.

⁴ 1 percent of the field cost was estimated for Easements non-contract costs.

⁵ 3 percent of the field cost was estimated for Cultural Resources non-contract costs.

⁶ Interest During Construction was estimated over 4 years of construction at the current Federal discount rate of 4 percent.

⁷ Interest and Amortization of the capital cost was estimated over 50 years at the current Federal discount rate of 4 percent.

⁸ Annual Operations and Maintenance costs were estimated at 0.2 percent of the field cost.

⁹ Dry-Year Crop Insurance/Fallowing Program annual cost is estimated at \$100 per acre of land following plus an administrative cost at 20 percent of the fee. This alternative would require 10 percent demand reduction in Truckee and Carson Division agriculture.

Key:

\$ million = million dollars

HDPE = high-density polyethylene

Accomplishments

Safety

Alternative 250.d and all other alternatives formulated and selected by the Study meet the RR3 level of risk reduction required to achieve the Study's safety objective.

Water Supply

Iterations of Alternative 250.d showed that fallowing 10 percent of water-righted agricultural land in dry years is sufficient to achieve a desired level of reliability (see Appendix F). Alternative 250.d meets or exceeds both of the conditions needed to achieve the Study's water supply objective: (1) the long-term average delivery of Project water (95.5 percent) exceeds that of the Desired Reliability scenario (94.6 percent); and (2) as shown in Figure 5-12, the largest annual difference in supply relative to the Desired Reliability scenario is approximately negative-9,000 acre-feet, which meets the desired negative-10,000 acre-foot threshold

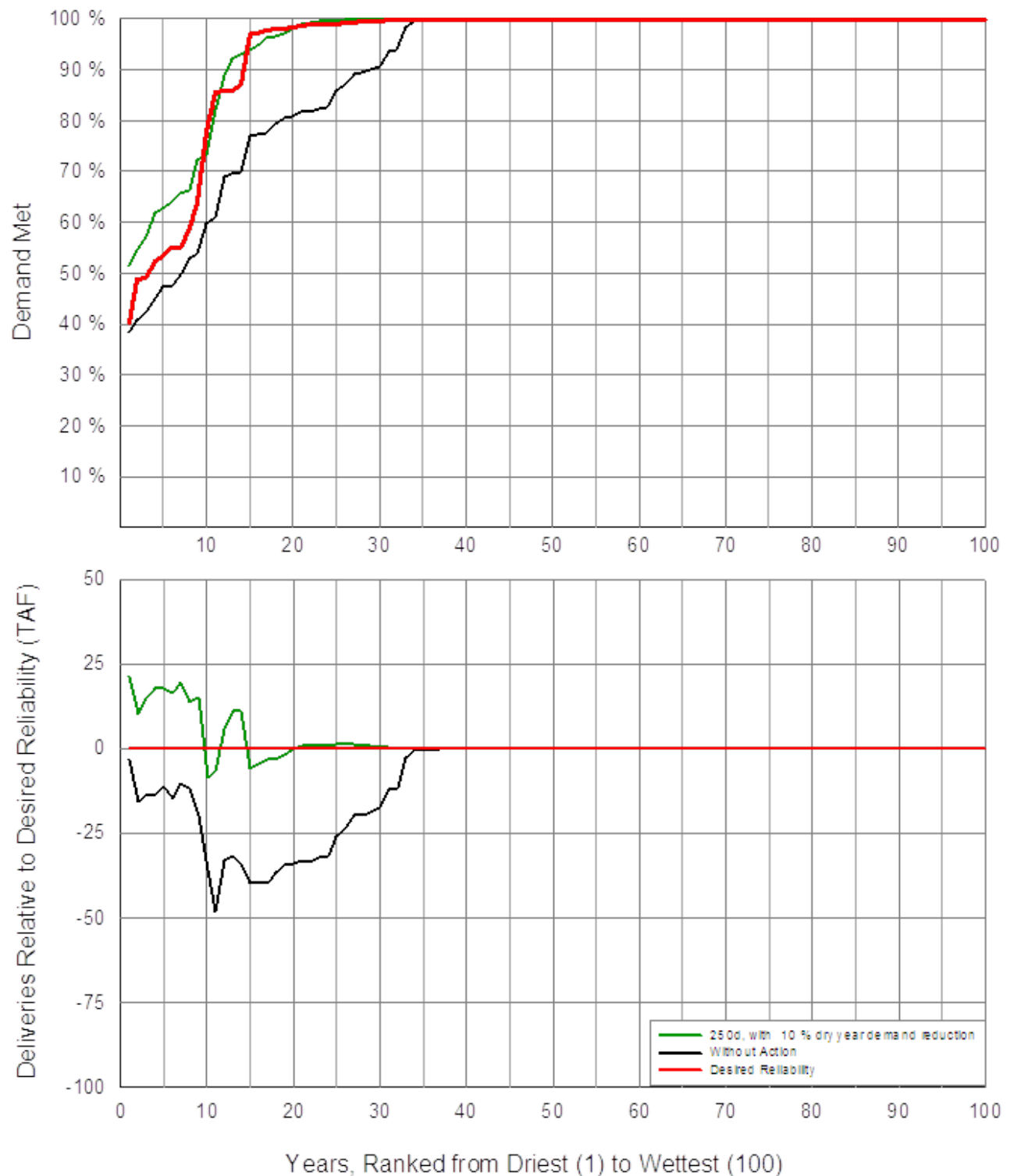


Figure 5-12. Water Supply Performance of Alternative 250.d

Project Efficiency

Alternative 250.d plans for a Project efficiency of 65 percent, and includes no actions to increase efficiency.

Seepage losses from the Truckee Canal are reduced by approximately 85 percent under this alternative.

Water Quantity and Quality on Lower Truckee River

The average annual volume of water in the lower Truckee River for Alternative 250.d is greater than that of the Desired Reliability condition but less than that of the Without-Action Alternative.

- **Relative to the Desired Reliability** – Increase in Truckee River flow of 31,000 acre-feet annually.
- **Relative to the Without-Action Alternative condition** – Decrease in Truckee River flow of 15,000 acre-feet annually.

Hydropower Generation

Hydropower generation is increased under Alternative 250.d relative to the Without-Action Alternative. Average generation at Lahontan Powerplant and 26-Foot Drop powerplant is 15,412 MWh and 4,808 MWh annually, respectively.

Preliminary Alternative Review

Environmental outcomes and regulatory requirements would be similar to those under alternatives 250.a and 350.d, when compared to the Without-Action Alternative. This alternative would have a similar level of water diversion as alternatives 250.a and 250.b, and the same construction effects as Alternatives 350.d. This would result in substantially less canal seepage, which would reduce the groundwater contributions in the Truckee Division. Temporary agricultural land fallowing would also occur under this alternative, and would result in similar effects as under Alternative 250.a, but to a lesser extent.

Environmental Outcomes

Alternative 250.d's outcomes for species and habitat in the study areas would be similar to those for all other alternatives when compared to the Without-Action Alternative: species that use the Lahontan Reservoir and Carson Lake would experience increases in water quality and quantity; wetland and riparian areas adjacent to the Lahontan Reservoir and Carson Lake may increase in extent; species in the Truckee River and Pyramid Lake would experience decreases in water quantity and quality; and wetlands and riparian resources in the vicinity of the Truckee River and Pyramid Lake may decrease in extent (Reclamation 2000).

Deliveries to Lahontan Reservoir and the Carson Division would increase as compared to the Without-Action Alternative. Increased availability of

groundwater and return flows within the Carson Division would benefit Stillwater NWR. The availability of these flows would increase when compared to the Without-action alternative, but to a lesser extent than under the 600 and 350 cfs alternatives, and would be offset somewhat by reduced return flows related to dry-year fallowing.

Similar to Alternative 250.a, changes in land cover could also result in decreases in air quality from an increase in fugitive dust produced on fallow land (Churchill County 2012). Other temporary effects from fallowing could include an increase in noxious weeds, and decreased revenue for local businesses that support the agricultural industry (Churchill County 2012). Weeds and dust effects could be mitigated to some degree by continuing to apply some amount of water to the land (Brad Goetsch and Eleanor Lockwood, Churchill County, personal communication, August 25, 2011; public comments, August 2011). Previous examples of this effect within the Newlands Project include a portion of Swingle Bench where USFWS acquired and retired land without implementing such mitigation measures (public comments, August 2011).

The City of Fernley relies on seepage from the Truckee Canal to replenish the local aquifer, which is used for municipal and industrial water, although this is not a valid Project delivery. Alternative 250.d's concrete geomembrane lining of the Truckee Canal would eliminate seepage into the local aquifer, thus reducing Fernley's ability to meet its total municipal demand (City of Fernley 2012). Appendix B4 contains correspondence between Reclamation and the City of Fernley regarding Fernley's reliance on seepage from the Truckee Canal.

Construction effects from the Truckee Canal safety improvements would be very similar or identical to those noted for Alternative 350.d: construction activities could affect water quality and there is potential for construction noise to disturb nearby residents in some places.

Regulatory Review

A list of Federal, State, and local regulations that may be applicable is summarized in Table 5-1.

Federal Requirements Federal requirements for permitting and consultation are identical to those for Alternatives 350.d: consultation with the USACE and USFWS would take place to identify permitting requirements; consultation with the Pyramid Lake Paiute and Fallon Paiute Shoshone tribes would be required related to Indian Trust Assets; and consultation with the Nevada SHPO would be required to assess any potential negative effects on NRHP-listed project features. NEPA compliance would be necessary, and an EIS may be required to sufficiently evaluate effects.

State and Local Requirements State and local requirements for consultation and permitting are likely identical to those for all other alternatives, potentially including: a Surface Area Disturbance Permit from NDEP, Bureau of Air Pollution; Construction Stormwater and Working in Waterways permits from NDEP, Bureau of Water Pollution Control; and encroachment permits from Lyon, Storey, or Churchill counties.

Economics

TCID Ability to Pay

Under Alternative 250.d, TCID's ability to pay is estimated at \$6.90 million annually. This is an improvement over the Without-Action Alternative of about \$1.90 million.

Preliminary Benefits

All preliminary benefits for Alternative 250.d are estimated in relation to conditions under the Without-Action Alternative. Although not quantified in the Study, safety to the City of Fernley is a primary benefit of Alternative 250.d. Benefits to agricultural, wetlands and M&I water supplies factor in the average water supply reliability of 95.5 percent that occurs under Alternative 250.d. Average annual revenue from hydropower generation increases \$0.12 million over the Without-Action Alternative. The annual benefit of increased agricultural water supply for the Project is estimated at \$0.99 million. The annual benefit of increased supply to wetlands is \$0.46 million. The annual benefit of increased M&I supply is estimated at \$0.01 million.

Implementation Considerations

Compatibility with Applicable Laws, Policies, and Plans

Alternative 250.d is anticipated to be compatible with all existing laws and policies. It is also compatible with recent Truckee Canal rehabilitation actions taken by TCID to remove the 33 existing conduits to the laterals and replace them with 17 structures that include both lateral and stock line delivery features (TCID 2012b).

It is possible that the actions in Alternative 250.d may require a more extensive NEPA evaluation before implementation (see "Preliminary Alternative Review" subsection above), such as an EIS rather than an EA.

Federal and Non-Federal Roles and Responsibilities

Reclamation would likely be the Federal lead for permitting and NEPA compliance. As the local contractor, TCID would likely obtain State and local permits related to construction activities.

Potential for Cost-Sharing

TCID TCID should be considered a potential cost-share partner because Alternative 250.d significantly increases the water supply reliability

experienced by its customers, which in turn improves its hydropower generation capacity—one of the largest sources of annual revenue for the district.

City of Fernley The City of Fernley should be considered as a potential cost-share partner for at least feasibility assessments of Study alternatives. The benefit of life safety and averted flood damage reduction would serve as a portion of the benefit that the city derives from the Study alternatives.

Pyramid Lake Paiute Tribe The Pyramid Lake Paiute Tribe should be considered as a potential cost-share partner. Among the range of alternatives available for meeting the Study objectives, Alternative 250.d maintains a relatively high level of flows to Pyramid Lake.

Summary of Alternative 250.d

Table 5-15 below summarizes the performance, accomplishments, benefits, costs, and other characteristics of Alternative 250.d.

Table 5-15. Characteristics of Alternative 250.d

| | | Alternative 250.d | Without-Action Alternative | Desired Reliability Scenario |
|--|---|------------------------------|---------------------------------------|---|
| Major Features | Truckee Canal Flow Stage | 250 cfs | 150 cfs | 900 cfs |
| | Truckee Canal HDPE Cutoff Wall or Lining | Lining | - | NA |
| | Other Features | Following 10% in Dry Years | - | NA |
| Safety | | Meets RR3 | Uncertain ¹² | NA |
| Average Annual Project Water Delivery¹ (percent) | | 95.5% | 90.5% | 94.6% |
| Average Annual Project Delivery by User Category | Avg. Annual Deliveries to Ag/Irrigation (TAF) | 115.4 | 111.2 | NA |
| | Avg. Annual Deliveries to M&I (TAF) | 13.3 | 13.2 | NA |
| | Avg. Annual Deliveries to Lahontan Valley Wetlands ² (TAF) | 67.2 | 63.6 | NA |
| Annual Cost³ (millions) | | \$5.60 | NA | NA |
| TCID Ability-to-Pay¹³ (millions) | | \$6.90 | \$5.00 | NA ¹⁰ |
| Preliminary Benefits⁶ (annual) | Agricultural Water Supply Reliability (millions) | \$0.99 | NA | NA |
| | Wetlands/ Environmental Water Supply Reliability ⁴ (millions) | \$0.46 ⁵ | NA | NA |
| | M&I Water Supply Reliability (millions) | \$0.01 | NA | NA |
| | Hydropower Generation Revenue (millions) | \$0.12 | NA | NA |
| | Safety ⁷ | Increased | NA | NA |

Table 5-15. Characteristics of Alternative 250.d (contd.)

| | | Alternative 250.d | Without-Action Alternative | Desired Reliability Scenario |
|--|--|------------------------------|---|---|
| Environmental and Other Effects | Avg. Annual Spill to Stillwater NWR from Lahontan Dam (TAF) ⁸ | 12.7 | 11.0 | 12.5 |
| | Carson Division Groundwater and Agricultural Drain Flows ¹¹ | Reduced by fallowing | Reduced in comparison to current conditions | Similar to current conditions |
| | City of Fernley Demand Met ⁹ (percent) | 56% | 99% | 121% |
| | Avg. Annual Flow to Pyramid Lake (TAF) | 501 | 516 | 460 ¹⁴ |

Notes:

¹ Long-term average annual percent of Newlands Project demand met.

² Includes deliveries to Carson Lake and Pasture, the Fallon Paiute-Shoshone Tribal wetlands, and Stillwater NWR.

³ Annual costs include interest and amortization of the capital cost estimated over 50 years at the current federal discount rate of 4 percent. Costs also include annual operations and maintenance estimated at 0.2 percent of the field cost. For some alternatives with the Dry-Year Fallowing, annual costs for the program were estimated at \$100 per acre of land fallowing plus an administrative cost at 20 percent of the fee. For additional information, see Appendix E3.

⁴ Based on volume of deliveries to Carson Lake and Pasture, the Fallon Paiute-Shoshone Tribal wetlands, and Stillwater NWR, and also spills to Stillwater from Lahontan Dam. Excludes consideration of water supply from return flows and groundwater.

⁵ May be lower due to reductions in other supply sources resulting from implementation of Study alternatives, but which could not be quantified.

⁶ Preliminary benefits were estimated as the change between a Study alternative and the Without-Action Alternative for agricultural water supply, wetlands water supply, M&I water supply, and hydropower generation revenue. Water supply reliability under each Study alternative is factored into that alternative's benefits calculation. Benefits reported are annual, estimated over 50 years at the current Federal discount rate of 4 percent. For additional information, see appendixes D8, G1, and G2.

⁷ The benefits of improved safety have not been quantified for this Study, but would need to be more fully evaluated for a feasibility study or for cost-allocation purposes.

⁸ Spills are not considered a Project delivery, but are included in the calculation of benefits to wetlands.

⁹ The City of Fernley's municipal supply relies on groundwater available through incidental recharge from the Truckee Canal. While this is not a valid Project delivery, some alternatives would have the effect of reducing the availability of this groundwater. The demand met for the City of Fernley is noted as an environmental outcome. For additional information on how the Study evaluated the effects of Study alternatives on Fernley's ability to meet future demand, see Appendix B4.

¹⁰ Assessment of financial conditions was not conducted for the Desired Reliability scenario, because this scenario was developed to estimate a historical water supply reliability under current regulations and does not represent a current or future ability to pay.

¹¹ Effects of alternatives on Carson Division groundwater and agricultural drain flows are not quantifiable, and are described in comparison to current conditions.

¹² The 150 cfs flow stage is believed to pose a lower risk to the Fernley area because the water elevation in the canal would be maintained at a level low enough to minimize the risk of destabilizing the canal embankment. However, this is not a solution specifically designed to reduce risk of operating the canal, and thus the degree to which it meets the safety objective (RR3) is unknown.

¹³ Ability to pay estimates represents potential maximum increases to charges that TCID could apply to their customers while maintaining farm profitability, and are not reasonable to use as the sole basis for capital investment decisions. Ability to pay has been estimated using Reclamation guidelines and relies substantially upon the 5-year average for crop prices, which are volatile and presently on the higher end of historical ranges. For example, if alfalfa prices fell from current levels (\$155/ton) to levels experienced a decade ago (\$125/ton), TCID ability to pay could be reduced by as much as \$8.7 million per year. The estimated current ability of TCID to pay for projects and improvements beyond current obligations is \$6.50 million per year. (See Appendix G.)

¹⁴ Because the Desired Reliability scenario is based upon current demands, which are larger than the future demands used for Study alternatives, the flow to Pyramid Lake will automatically be somewhat higher for the alternatives than for the Desired Reliability scenario.

Key:

Avg. = average

cfs = cubic feet per second

M&I = municipal and industrial

NWR = National Wildlife Refuge

RR = risk rating

TAF = thousand acre-feet

TCID = Truckee Canal Irrigation District